CHEMICAL & Metallurgical ENGINEERING

For OCTOBER, 1945

• SURPLUS PROPERTY AVAILABLE TO CHEMICAL PROCESS INDUSTRIES • TARTRATES MADE FROM GRAPE POMACE • CHLORINE AND ACETYLENE INDUSTRIES IN WARTIME GERMANY • SELECTION OF CONTROL VARIABLES FOR CONTINUOUS DISTILLATION • FLOWSHEET SHOWS PRODUCTION OF CHEMICALS FROM SEARLES LAKE

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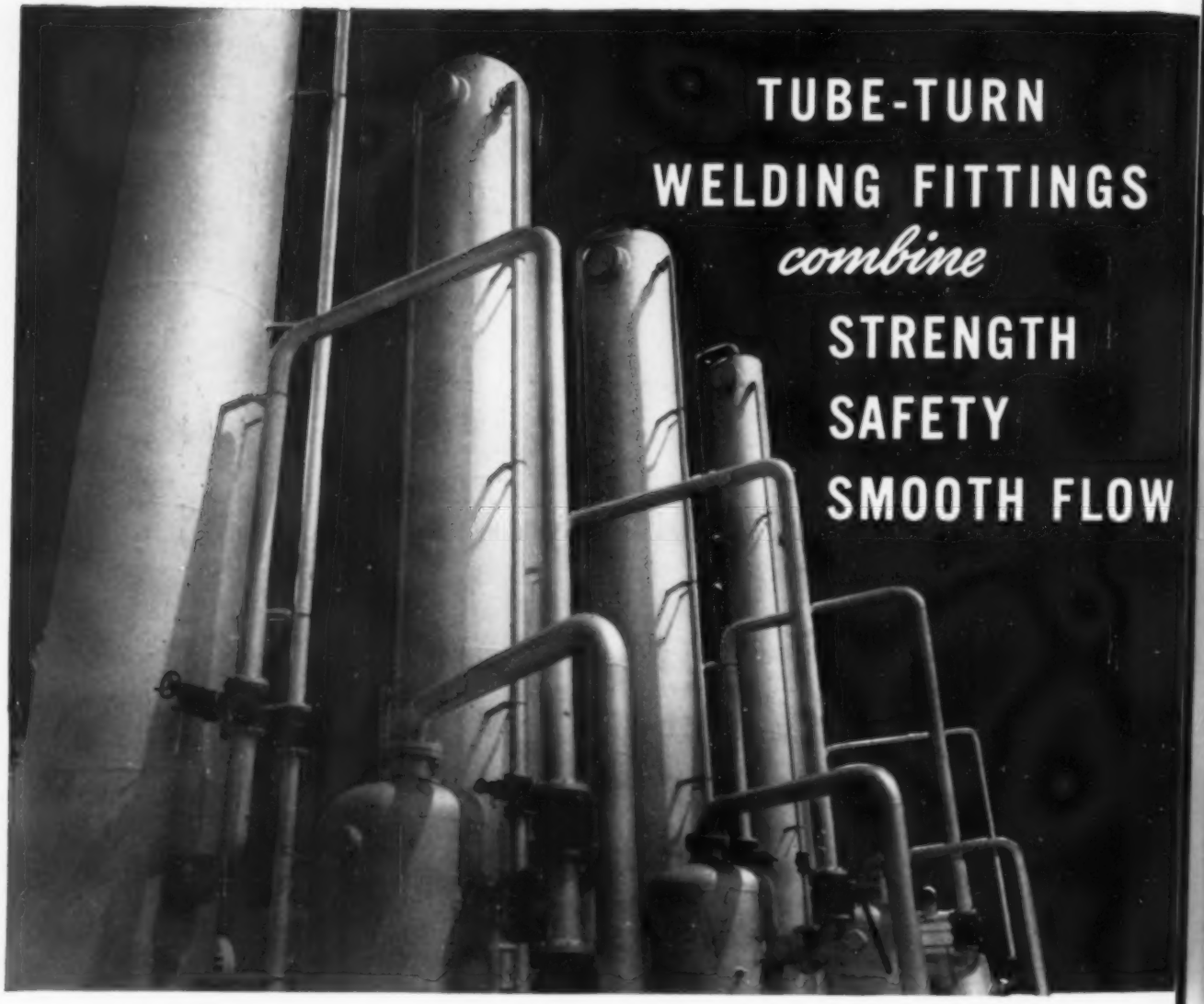

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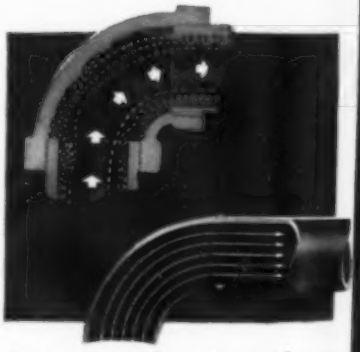

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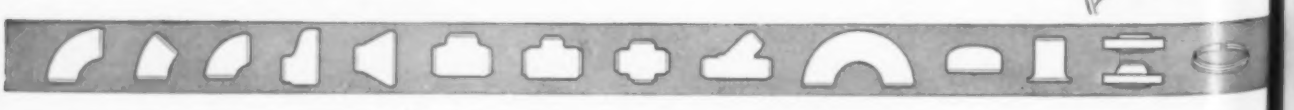

CHEMICAL & METALLURGICAL ENGINEERING

OCTOBER • 1945

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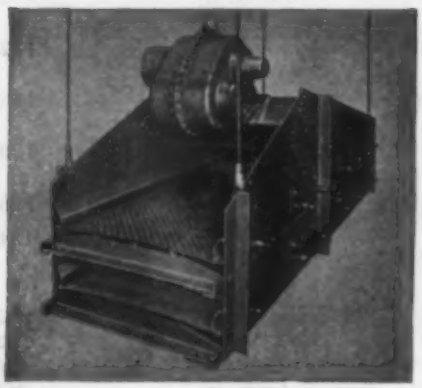

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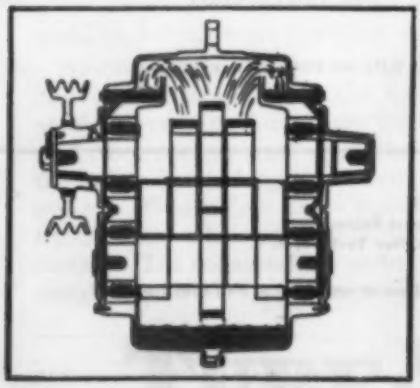

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OCTOBER 1945

Can We Control the Future?

TO SAY "we must" is not an answer to this most pressing problem of the peace. From every side come questions of international import that are as challenging to engineers and technical men as to statesmen and politicians. That we cannot hope to solve them with the precision and certainty of mathematical equations is no reason for not contributing our viewpoints and experience. *Chem. & Met.* therefore applauds and commends the thinking behind the engineers' report on plans for the industrial disarmament of Germany and also the signed statements of the Oak Ridge and other scientists who have tackled the much more complicated problem of controlling nuclear power.

More than a year ago the presidents of the five national engineering societies agreed upon a general plan for the industrial control of postwar Germany. When submitted to Washington, its sponsors were urged to make a more detailed study and to suggest specific measures for putting its recommendations into effect. Thirty-five qualified specialists in the fields of civil, mechanical, mining and metallurgical, electrical and chemical engineering cooperated in the preparation of the report that was submitted late last month to the State, War and Navy Departments, to the Commanding General of the Army Service Forces and to the civil and military authorities in the American zone of occupation in Germany.

The report was built around the expressed philosophy that "it is necessary to subtract from aggressor peoples, for a long period of recuperation, the fundamentals of their industrial war potential for armed aggression." At the same time it held that "complete elimination of German industries, leaving agriculture as the sole occupation, would produce an enormous dislocation and social chaos of destructive magnitude, not alone in Germany but throughout Europe." Working within the framework of the Yalta and Potsdam agreements, the engineers concluded that peace could be assured only through the maintenance of effective controls of power production and distribution and the following limitations on industrial plant construction and operation: (1) Prohibit the synthetic fixation of atmospheric nitrogen in Germany; (2) prohibit the production of synthetic liquid fuels; (3) prohibit the production of aluminum; (4) prohibit the development and use of atomic energy; and (5) limit the capacity and production of steel and its alloys to a level sufficient only for domestic peacetime needs. Secret scientific research and economic subsidies by the German government were likewise ruled out as fruitful sources of future war potentials.

To some these may seem altogether too drastic substitutes for the slower process of education that is probably our only permanent safeguard of the future. Yet they are the first essential steps of industrial control and if our relations with our Allies in the Joint Council permit them to be put into effect uniformly throughout Germany, we will have made progress toward our long-time objective of peace in that part of the world.

Because international control of the atomic bomb must apply to the entire world—to our friends as well as our enemies—it is much more difficult and complicated. We believe we should start with the clear understanding that the only real secrets involved are the "technical and engineering details of processes, plants and devices" (to quote the scientists who were responsible for the bomb's development). We must, if possible, set up the framework of our world authority on the basis that research in nuclear science and its technology should be encouraged for peacetime application, at the same time that military uses in wars of aggression are prevented, if necessary, by international intervention. The United States has the moral obligation to point the way. Difficult as is this problem, it cannot be solved without clear thinking and convincing presentation of the views of American scientists, engineers and technologists.

REPORT ON.....

SURPLUS PROPERTY
For Process Industries

Uncle Sam owns billions of dollars worth of process industry equipment and plants. *Chem. & Met.* has had its two Washington engineering representatives, Russell S. McBride and J. V. Hightower, make a critical study of this situation. The results are reported here. The sale of this property to present and prospective plant operators is now actively under way. The government has organized a technical staff with which chemical engineers can promptly do business. Therefore, those who have any concern with the many varieties of plants and facilities should investigate promptly those which have possible importance to them. Any company which does not do so may find that one of its competitors has achieved a substantial competitive advantage by more prompt and aggressive action.

PROCESS INDUSTRIES are offered by Uncle Sam many industrial plants and much process equipment that is surplus now the war is over. Several billion dollars' worth of such facilities were bought or built to meet war needs. Among the more important kinds of plants and equipment now offered for the use of companies in process industries are those built to manufacture the following classes of goods: Alcohol, explosives and ingredients or raw materials, sulphuric acid, ammonia and ammonium nitrate, oxygen and acetylene, caustic and chlorine, magnesium and aluminum and their raw materials, petroleum derivatives especially for aviation gasoline, coke and byproducts, rubber and rubber components, miscellaneous organic chemicals, and miscellaneous industrial inorganic chemicals.

No one really knows quite what is owned and can be offered for industrial use in all of these and the related fields. The aggregate is so great that it will take months to identify the surplus and offer it to those who may make peacetime use of it. But there is now gradually emerging from the confusion of Washington some useful, factual matter on the basis of which more specific purchase and lease effort can now be made by chemical engineers and executives.

This report undertakes to set forth in outline some of the ways in which process industry can acquire those facilities of most immediate value. This discussion follows one presented last month in *Chem. & Met.*, which dealt more specifically with the alkali plant surplus. Most of the principles discussed in that earlier article are applicable also to all of the classes of plants and facilities discussed here.

AMMONIA PLANT DISPOSAL

Disposal of certain ammonia facilities has perhaps advanced further than have the plans for use and disposal of any other class of chemical process equipment. There have been established quite a number of definite principles as to disposal which seem likely to apply generally. It is logical and convenient to discuss here these broad principles in relation to specific projects in the ammonia industry.

The government participated financially in the building of ten plants for the synthesis of ammonia. In eight cases the ownership of the plant was retained by the Army as a part of the military program. One plant built by the Army was transferred to TVA for ownership as well as operation. In another case the facilities were erected by Defense Plant Corp. with the expectation that the interested company would acquire title for postwar use. The latter case was Mathieson Alkali Works at Lake Charles, La.

There remain, for "surplus" discussion, therefore, the eight arsenal plants located at: Morgantown, W. Va.; South Point, Ohio; West Henderson, Ky.; Louisiana, Mo.; Baxter Springs, Kan.; Eldorado, Ark.; Sterlington, La.; and Dumas, Tex. Planning for the future of these has developed many problems for surplus property officers and the interested industry.

In the previous article on alkali plants the basic problem of preventing increase in monopoly by sale of surplus property has been briefly presented. That problem

was not serious for caustic and chlorine, because in no case did single companies have anything approaching a dominating position in the industry. The ammonia situation is very different. The prewar ammonia industry was very largely in the hands of Du Pont and Allied Chemical with all of the other producers together controlling only a modest percentage of the total capacity.

The Department of Justice is compelled by general responsibility and specifically in the Surplus Property Act to determine that government proceedings do not tend to increase the dominance of any one or two firms as the government property is sold. Apparently the Department of Justice has reached the conclusion that for the present the arsenal ammonia plants above referred to which were built by Du Pont or Allied should not be leased or sold to them for postwar use until other ammonia properties have been reasonably well established in the hands of firms which may be expected to be permanent members of the industry. There has been no such official finding formally reached, but procedure is to that effect.

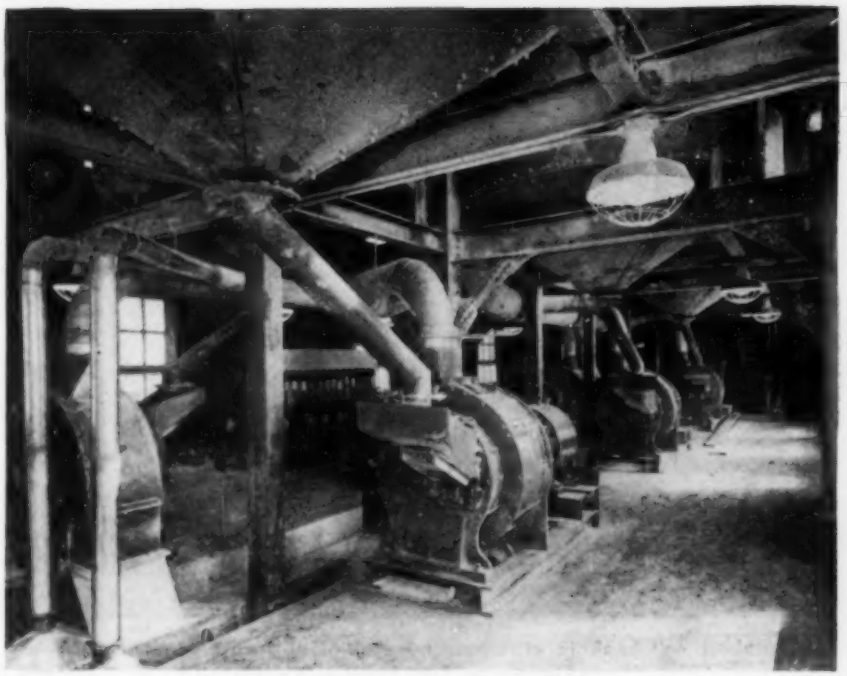
This monoply problem has been somewhat simplified by the fact that the Morgantown plant, built and operated by Du Pont, has actually become more a methanol works than an ammonia synthesis plant. It is generally understood in Washington that Du Pont might continue later to operate the works on that basis. Such plan does not tend to increase Du Pont control of ammonia through acquiring surplus property. But for the present the Morgantown plant is held by the Army in a standby status.

Allied Chemical is planning temporarily to operate the South Point, Ohio, plant for which it was builder and agent-operator. But it is understood that Allied will not soon seek to get full control either of that works or of the West Henderson works. Thus the monopoly problem is "solved" temporarily; and the Department of Justice may for a time escape the necessity of taking formal action on monopoly characteristics of ammonia works.

ALCOA RESTRICTED

Much more drastic action has been taken with respect to aluminum plants which were operated for war purposes by Aluminum Co. of America. Effective at the end of October such plants making metal at four locations and making alumina at two locations will no longer be under lease to Alcoa. Reconstruction Finance Corp. gave formal notice to this effect early in September so that the property could be declared surplus and be disposed of under the Surplus Property Act.

This action was taken, it is understood, in order that the Department of Justice veto need not be exercised on any proposed leases or contracts for these establishments. As a consequence, all sorts of rumors developed in Washington. One of these is known to be true, namely, that RFC is trying to find someone else to operate these works in order to create effective competition in the making of alumina and the making of aluminum.



Prater mills for conversion of whole grain to meal in government-owned alcohol plant at Kansas City, Mo.

Most talked of as successful competitor is Reynolds Metals Co. which has been the operator of certain other facilities of the government. Also requested to make offerings have been other large firms which have made other metals successfully. But no prompt offers have been forthcoming and it remains a grave question in Washington whether anyone else, except Reynolds, cares to embark on so strenuous a competitive effort.

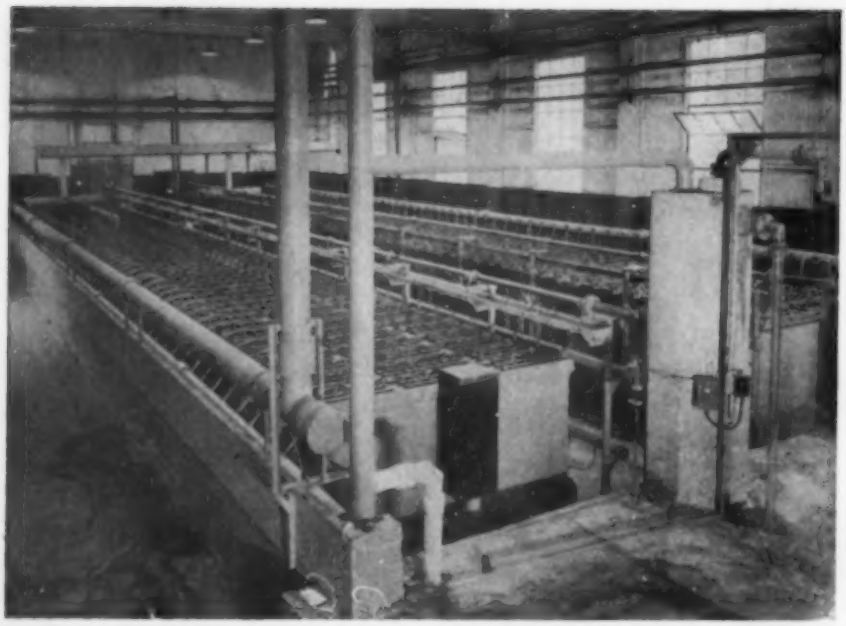
The dominance of Dow Chemical Co. in production of magnesium before the war was quite as conspicuous as Alcoa in the aluminum field. The multiplication of capacity for magnesium for war purposes was even greater in percentage. In some respects, therefore, it was expected that Dow would get the same restrictive action as Alcoa when Justice and RFC took surplus action. Slightly different developments have apparently occurred.

Most wartime producers of magnesium have frankly said to the government that they do not want to stay in this business. The total tonnage prospect has been too small and their chance of low cost production has been too little to provide real attraction. Practically all plants not operated by Dow are, therefore, "surplus" largely by decision of their wartime operators. One or two exceptions are hinted at in Washington, most frequently Diamond Alkali. These exceptions are firms which can produce the raw material magnesia or magnesium chloride as a by-product of other chemical operations. Apparently only such interlocking of magnesium with chemical business is going to be the basis of any attempt at postwar operation. And even several companies which had the magnesium business somewhat interwoven with other activities have withdrawn formally.

First on the counter for sale or lease was the Nevada magnesium plant operated at the end of the war by Anaconda under the name Basic Magnesium Inc. RFC is making strenuous efforts to convert that establishment to other uses. As discussed in the previous article, the caustic and chlorine facilities there are getting first attention, on the theory that they may be permanently employed in that location. Vigorous effort is being made also to change the other facilities in such a way that they can be adapted to new products. The portions of the plant not useful in that manner will then be sold as surplus equipment or as material for salvage. But the prime objective is to keep at Las Vegas some kind of enterprise for new products using as much as possible of the huge magnesium plant, even though that plant certanly will not be continued for the making of the light metal.

NEW AMMONIA MAKERS

The prospect of synthesis of ammonia at surplus arsenal plants has been much more attractive to chemical industry than the prospect of making light metals at the works just described. There have been



Electrolytic cell bank in government-owned plant for the manufacture of chlorates at Los Angeles, Calif.

five companies operating these arsenals, other than the two firms most conspicuous in prewar ammonia. All five of these have been urged to become lessees of the surplus establishments which they have been operating as a war service. As a result, negotiations have been vigorously prosecuted by RFC with several of these companies.

Washington understands that the Hercules-operated plant in Missouri and the Shell Chemical plant in Texas are not likely to continue in the ammonia business in the near future. The high price for natural gas and other factors have made the Missouri works one of high over-all cost. The plant in the Panhandle of Texas seems too far from markets to be attractive.

The remaining three works are under discussion with RFC by Military Chemical Works, Lion Chemical Co. and Commercial Solvents Corp. It is no secret in Washington that all three of these firms would like to get quickly into the business of making ammonia and nitrogen-fertilizer derivatives. All three also talk of making methanol, which can be produced in ammonia facilities with very small change in equipment and methods. All three expect to arrange short-term leases with certain rights for later purchase of the plants. In fact, these three cases have been among those most effective in establishing certain principles of industrial property selling under the Surplus Property Act.

QUICK ACTION ASKED

For many reasons it is essential that quick action be taken in surplus disposal. Most important of these, in the case of industrial property, is the need for getting these facilities into use so that employment may begin on a peacetime business.

In many cases firms would like to buy property outright, but cannot quickly agree with the government on the value of the property and the terms of payment. In such cases it is being urged by the government that short-term leases be made which will permit negotiation during the lease period for the final settlement of the sale to the lessee.

That plan might be an acceptable one between two business firms. But it is proving rather difficult to follow that simple policy when the government is one party to the lease. No one feels sure that government officials will be able to come to "business-like" terms with the lessee, because of the complications of doing business on behalf of the government. What seems to businessmen to be a favorable and fair deal is often subject to political criticism and charges of graft or improper administration. Thus a number of contracts which appeared already for signing during September have not been as promptly settled as had been expected.

Congress made it clear in establishing the Surplus Property Board that it did not expect the government to get back into the Treasury the full cost of war plants. That was merely an admission by the law makers of an obvious conclusion, since many plants are certainly not worth anything like as much for peace uses as they probably cost during the war.

There have been dozens of proposals as to the basis of valuation to be used by the government in making its surplus property sales. It was evident that mere competitive bidding would not produce a desirable result. Many most desirable prospective users of these plants refuse to offer such bids on the ground that they really did not know what situations they were undertaking to appraise. Consequently the Board early in September issued its special order No. 79 defining the conditions under which they proposed to value surplus industrial property. The significant portion of that order reads as follows:

"The fair value shall be considered to be the maximum price which a well-informed buyer acting intelligently and voluntarily, would be warranted in paying if he were acquiring the property for long-term investment or for continued use with the intention of devoting it to a profit-making purpose which represents the most productive type of use for which the property is suitable. The estimate shall take into account only those rights in land, structures, facilities, or equipment which would be of use to such a buyer and only to the degree to which they would be of use. It shall be recognized that the fair value of the property is not in excess of the prices at which other similar properties having a like utility and productive capacity are actually available on the market or in excess of the total cost which would be required to secure an equally useful site and erect and equip similarly useful structures. Neither the original cost to the government nor the characteristics or readiness to buy of any particular prospective purchaser shall be taken into account. The disposal agency shall maintain an adequate written record to support its estimate of fair value and for this purpose may, if necessary, incur reasonable expenses for services by qualified persons, including appraisers, consultants, or other government agencies."

SIZE OF PLANTS

Even with such a precise definition of intended valuation the arrangement of purchase rights as a part of interim rental has not been easy. Most difficult of all has been a determination as to how much of a particular plant was really useful for the postwar period. For example, it was evident that certain ammonia plants designed to make 300 tons of ammonia per day, and capable of making nearly 500, were two or three times as large as could be usefully operated in their locations in the immediate future. It is a question, therefore, as to whether a purchaser of such facilities is going to buy the whole plant for what it would be worth if it all could be used, or whether he should buy a third or a half of the plant which certainly is the most that he wants immediately. Naturally the "value" would differ radically according to the assumption made in these circumstances.

In one or two instances a partial solution of this problem has been reached by identifying the portions of the plant which the would-be purchaser does not need and which the government can dispose of separately, either for salvage or scrap, or for sale to be used elsewhere, possibly abroad. The valuation of the residual works after removal of such facilities has proven much more practical. But the government has still preferred not to break up an establishment in that manner since it obviously realizes much less is received for the portion of the plant taken away for scrap or by moving than is received for the part which remains in its wartime location.

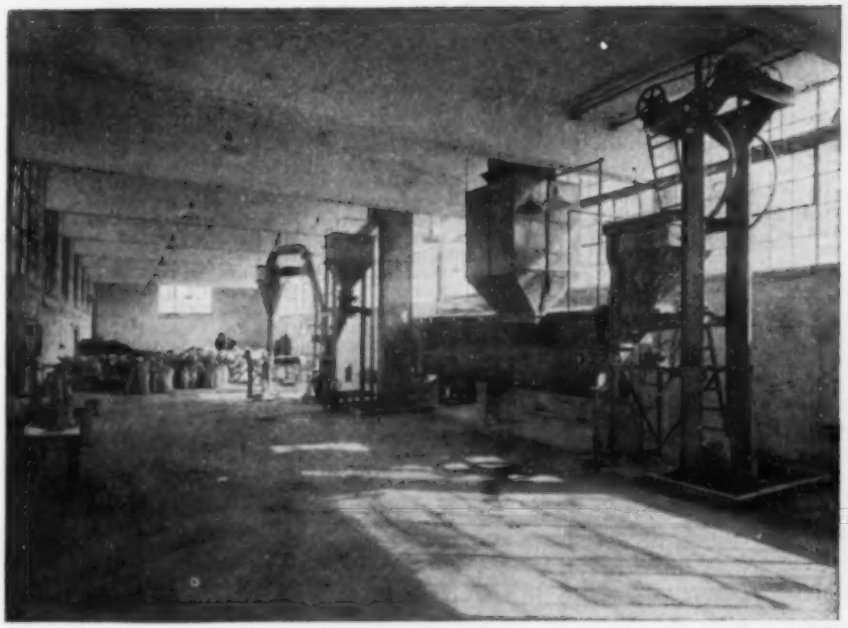
Settlement of these questions, as to the size to the works which is to be included in a sale, may be postponed under one circumstance without too great difficulty. That possibility develops when the would-be purchaser agrees to buy so much of the works as he finds he can use after several years of lease. Thus the actual experience in operation during three to five years can determine whether the government is going to sell the entire establishment to the lessee, or only part of it. The government then remains responsible for removal and disposal of the unwanted portions as soon as the lessee knows that he does not require them permanently in his business.

TERMS OF LEASES

The Surplus Property Act has provided that a lease up to five years may be made rather readily. Such a period is much shorter than was provided for in a number of the Army contracts for arsenal establishments. When a lease of that brief period is accepted by a company, it is usually asked to surrender to the government its previous rights in the option to buy or to lease for a long period. In other words, new tentative sales arrangements are intended to supersede completely the wartime contracts.

When a firm leases or purchases an establishment it is also expected in most circumstances to assume several obligations not borne by wartime operators. All the cost for local taxes is usually imposed on a lessee, and certainly must be assumed by a purchaser. The government has been exempt from these taxes in many cases; but does not attempt to retain this military exemption for the property when it passes into commercial use. That is, of course, a proper change in attitude in order to protect state, county, and local government groups from having in their midst large non-taxable enterprises.

In most cases leases also require that the lessee assume responsibility for all protection, maintenance, and repair, including the cost of insurance. The government seldom carries insurance on its property; but it usually requires lessees to do so. And the cost for taxes and insurance assumed under leases is not a negligible factor in the cost of doing business, especially when only a portion of the plant is to be put into immediate industrial use.



Drying and grinding equipment in a Los Angeles chlorate plant, which has been operated by Western Electrochemical Co.

The government expects when it leases an establishment to get some suitable rental. Varied proposals have been made and no fixed policy has been generally applied as yet. In some cases the idea is that the rental will be a fixed sum. In other cases a percentage of sales realization is to be paid to the government for rent, either with or without an agreement on a minimum sum regardless of the sales achieved. There are, in fact, as many methods of calculating rental contracts as there are varieties of firms talking business with Surplus Property officers.

MILITARY POLICY

A few months ago it appeared that the government was going to impose severe restrictions on the maintenance and use of much war property when it passed to private control. Among other things it looked as though the Army was going to ask for continued maintenance of these facilities in a readiness-to-serve condition so that they might be available in the event of another military emergency.

That attitude appears to have changed very radically since V-J Day. One would think, to listen to some Washington conversation, that the United States is now certain that it never again will require such facilities for a war. This seems to be more than mere wishful thinking. It seems to reflect for many plants a considered policy which has never been announced, but evidently has been settled at high official levels. One can only speculate on this point; but it does appear that in individual discussions we have to follow the following reasoning.

The United States is now so powerful in a military way that the rest of the world is certainly not going to attack it for quite a number of years to come. Use of the atomic bomb has so changed the military concept of future war that no one can even guess as to what we might want in the event of future hostilities. Under these circumstances the government does not need to reserve for itself any continuing military rights in many of the wartime establishments declared surplus.

That extreme opinion is certainly being applied in practice to a considerable variety of establishments, whether it is consciously and officially so decided or not. Hence in the manufacture of most industrial goods having both war and peacetime applications it is apparently the plan to let American industry go ahead about as it wishes. Nevertheless there will always remain the fact that the government could in time of emergency take over whatever it needs of existing facilities for its own use. Thus the abandonment of a direct military reserve of some types of manufacturing capacity is not as extreme a measure as it might seem at first. Companies in dealing with surplus industrial plants can enter future negotiations almost completely on the assumption that preparedness restrictions need no longer be a factor in their planning.

This generalization is, however, limited in one way. There are certain kinds of establishments which have not yet been declared surplus; and any dealings with respect to them are, therefore, almost wholly

Principal Aviation Gasoline and Related Plants

Plancor	Operator	Sponsor	Plant Location	Product	Approx. Daily Capacity	Approx. Government Investment
880	Abercrombie-Harrison Oil Co.	PAW	Sweeny, Tex.	100 octane	8,000 bbl.	27,500
1067	Ashland Oil & Ref. Co.	PAW	Catlettsburg, Ky.	100 octane	3,900 bbl.	16,000
1056	Associated Refineries	PAW	Beckett, Okla.	100 octane	4,800 bbl.	14,300
1042	Continental Oil Co.	PAW	Ponca City, Okla.	100 octane	5,000 bbl.	16,500
959	Cooperative Refinery Ass'n.	PAW	Coffeyville, Kan.	100 octane	1,700 bbl.	6,000
1068	Crown-Central Petr. Corp.	PAW	Houston, Tex.	100 octane	3,900 bbl.	15,300
911 & 1534	Eastern States Petr Co.	PAW	Houston, Tex.	100 octane	3,000 bbl.	11,500
1146	Frontier Refining Corp.	PAW	Cheyenne, Wyo.	100 octane	1,500 bbl.	7,800
628	Great Southern Corp.	PAW	Corpus Christi, Tex.	100 octane	3,000 bbl.	7,900
1041	Mohawk Petr. Corp.	PAW	Bakersfield, Calif.	100 octane	1,300 bbl.	4,400
1044	Pennsoil Co.	PAW	Oil City, Pa.	100 octane	1,700 bbl.	4,400
592	Premier Oil Ref. Co.	PAW	Cotton Valley, La.	100 octane	2,200 bbl.	6,500
718	Republic Oil Ref. Co.	PAW	Texas City, Tex.	100 octane	4,000 bbl.	11,200
689	Root Petroleum Co.	PAW	El Dorado, Ark.	100 octane	1,600 bbl.	6,200
591	Southport Petroleum Co.	PAW	Texas City, Tex.	100 octane	3,000 bbl.	11,100
1533	Std. Oil Co. of California	PAW	Richmond, Calif.	100 octane	8,000 bbl.	20,600
1164	Utah Oil Ref. Co.	PAW	Salt Lake City, Utah	100 octane	5,500 bbl.	15,300
912	Wilshire Oil Co.	PAW	Norwalk, Calif.	100 octane	3,800 bbl.	8,100
1036	Anderson-Prichard Ref. Corp.	PAW	Cyril, Okla.	Butane	300 bbl.	240
1220	Bay Petroleum Corp.	PAW	Denver, Colo.	Butane	130 bbl.	130
1871	Pan American Ref. Corp.	PAW	Texas City, Tex.	Isopentane	2,000 bbl.	2,800
542	Pure Oil Co.	PAW	Smith Bluff, Tex.	Alkylate	900 bbl.	3,200
1909	Humble Oil & Ref. Co.	PAW	Baytown, Tex.	Hydropolymer	8,000 bbl.	4,100
1868	Std. Oil Co. of New Jersey	PAW	Baton Rouge, La.	Hydrocodimer	.....	2,300
832	Continental Oil Co.	PAW	Ponca City, Okla.	Toluene, etc.	170 bbl.	1,300
1358	Amer. Cyanamid & Chem. Co.	PAW & WPB	Fort Worth, Tex.	Cracking catalyst	30 tons	3,400
1343	Chicago Chemical Co.	PAW	Chicago, Ill.	Cracking catalyst	20 tons	950
2440	Davison Chemical Co.	PAW	Baltimore, Md.	Cracking catalyst	13 tons	2,000
1458	Diakel Corp.	PAW	Cincinnati, Ohio	Cracking catalyst	40 tons	2,600
1324	Houdry Process Corp.	PAW	Paulsboro, N. J.	Cracking catalyst	5 tons	1,000
2072	Pennsylvania Salt Mfg. Co.	WPB	Philadelphia, Pa.	Hydrofluoric	22 tons	80
1065	Std. Oil Co. of New Jersey	Ordnance	Baton Rouge, La.	Toluene	.....	2,800
933	Magnolia Petroleum Co.	Ordnance	Beaumont, Tex.	Toluene	.....	3,200

Sulphuric Acid and Oleum Plants

Plancor	Operator	Sponsor	Plant Location	Product	Approx. Annual Capacity, Tons	Approx. Government Investment, $1,000
2347	Consolidated Chemical Industries	WPB	Houston, Tex.	Oleum	92,400	60
681	Davison Chemical Corp.	WPB	Baltimore, Md.	Acid	90,000	850
1018 & 2362	General Chemical Co.	WPB	Chicago, Ill.	Oleum & Acid	120,500[1]	580[4]
1019 & 2329	General Chemical Co.	WPB	Newell, Pa.	Oleum & Acid	330,000[2]	1,200
1020	General Chemical Co.	WPB	Buffalo, N. Y.	Oleum (40%)	100,000	820
1021 & 2328	General Chemical Co.	WPB	Cleveland, Ohio	Oleum & Acid	120,000[3]	610
2006	General Chemical Co.	WPB	El Segundo, Calif.	Acid[4]	65,000[4]	330[4]
2027	General Chemical Co.	WPB	Richmond, Calif.	Acid	65,000	500
2071	General Chemical Co.	WPB	Denver, Colo.	Acid	25,000	200
2092	General Chemical Co.	WPB	Front Royal, Va.	Acid	175,000	1,100
2330	General Chemical Co.	WPB	E. St. Louis, Ill.	Acid	48,000	120
742	Ozark Chemical Defense Corp.	WPB	Tulsa, Okla.	Oleum	98,000	1,260
1711	Southern Acid & Sulphur Co.	WPB	Beaumont, Tex.	Acid	90	740
2331	Stauffer Chemical Co.	WPB	Hammond, Ind.	Acid	72,000	340

[1] Consists of 72,500 tons of 40% oleum and 48,000 tons of sulphuric acid. [2] Consists of 280,000 tons of 40% oleum and 50,000 tons of sulphuric acid. [3] Consists of 70,000 tons of 40% oleum and 50,000 tons of sulphuric acid. [4] Exclusive of facilities for hydrofluoric acid manufacture.

Smokeless Powder and High Explosives Plants

Ordnance Works	Operator	Plant Location	Capacity, 1,000,000 Lb. per Mo.	Approximate Investment, $1,000,000
Alabama	Du Pont	Sylacauga, Ala.	40.7[1]	76
Badger	Hercules Powder	Baraboo, Wis.	20.0[2]	126
Chickasaw	Du Pont	Millington, Tenn.	15.5[3]	29
Gopher	Du Pont	Rosemount, Minn.	28.5[3]	129
Holston	Tennessee Eastman	Kingsport, Tenn.	43.5[4]	129
Indiana	Du Pont	Charlestown, Ind.	33.5[3]	177
Kankakee	United States Rubber	Joliet, Ill.	35.2[5]	56
Kentucky	Atlas Powder	Paducah, Ky.	18.0[6]	21
Keystone	Fraser-Brace	Meadville, Pa.	27.0[6]	54[7]
Longhorn	Monsanto	Marshall, Tex.	16.5[6]	22
Maumelle	Cities Service Defense	Little Rock, Ark.	4.5[6]	14
New York	National Aniline Defense	Syracuse, N. Y.	3.5[6]	14
Oklahoma	Du Pont	Pryor, Okla.	25.6[3]	70
Plum Brook	Trojan Powder	Sandusky, Ohio	34.2[10]	50
Radford	Hercules Powder	Radford, Va.	16.5[11]	94[12]
Sunflower	Hercules Powder	Lawrence, Kan.	23.0[3]	104
Volunteer	Hercules Powder	Chattanooga, Tenn.	45.0[3]	52
Wabash River	Du Pont	Newport, Ind.	10.2[13]	42
Weldon Spring	Atlas Powder	Weldon Spring, Mo.	45.0[6]	60
West Virginia	General Chemical Defense	Point Pleasant, W. Va.	35.0[6]	31

[1] TNT, 24.0; Tetryl, 2.2; powder, 14.5. [2] Powder only. [3] TNT, 7.0; powder, 8.5. [4] RDX, Composition B. [5] TNT, 32.0; Tetryl, 2.2. [6] TNT only. [7] Includes oleum plant operated by General Chemical Meadville Corp. [8] Ammonium picrate only. [9] TNT, 12.0; Tetryl, 1.1; powder, 12.5. [10] TNT, 32.0; Pentolite, 1.2. [11] Pentolite, 1.0; powder, 15.5. [12] Includes TNT facilities which have been largely stripped. [13] RDX (A, B and C mixtures).

impractical except for leases which do not include any firm and useful option to buy. When the postwar size of Army and Navy and the postwar preparedness program have been fixed by Congress, then, and only then, will these reserved plants be usefully open to discussion.

RUBBER PROBLEM

Many industrial properties that will ultimately become surplus have not yet reached that status. Outstanding is the group of plants making rubber chemicals and synthetic rubber. Disposal of those facilities requires first of all the establishment of a primary government policy for the postwar period.

The President has recognized this and has directed John Snyder to organize a special committee to make a study of a proper national policy with respect to natural rubber, synthetic rubber, and reclaimed rubber for postwar use. The policy

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AVIATION GASOLINE

Peace in the Pacific has cut heavily into the operation of the government-owned aviation gasoline plants. Portions of the facilities, notably units for manufacturing isobutane, are no longer required. A number of lessees have indicated their intention to give up the properties, this includes operators of the toluene plants, which were supplying toluene either for aviation gasoline or explosives.

On the other hand, nearly all the operators of catalytic cracking units in the 100 octane aviation gasoline plants were operating these units on October 1 for the production of high-octane motor gasoline. This is an illustration of the ready convertibility of petroleum refining equipment. Even before the war, catalytic cracking units were profitably making motor gasoline. A further advantage of these units is that they can produce quantities of aromatics, olefins, isoparaffins and other materials of importance to the chemical industry.

The aviation industry has embarked on an expansion program both at home and in the international realm. This means an increased demand for aviation gasoline. Whether the demand will soon reach the 522,000 bbl. per day capacity of America's equipment is highly conjectural. Before Pearl Harbor the daily production was only about 50,000 bbl.

SULPHURIC ACID

As the onset of war demanded the expansion of capacity for sulphuric acid and oleum production, so has peace slashed that demand. In 1941 production of sulphuric acid (100 percent) was reported as 6,770,000 tons. Production in 1944 was 8,540,000 tons, an increase of 25 percent. Today, the government-owned oleum and sulphuric acid plants are on the "available" list. Clients are welcomed by RFC.

A bright spot in the acid outlook is the fertilizer industry which was the leading consumer of sulphuric acid last year. Demand for the acid in this field promises to increase, according to government authorities who point to a gathering drive on soil depletion with or without benefit of Washington. Also, the steel and petroleum refining industries, both heavy consumers of the acid, may be counted on to absorb much of our productive capacity.

POWDER AND EXPLOSIVES

What can we do with the smokeless powder and high explosives plants the government owns? At the strictly "explosives" end, little. Fortunately, an appreciable part of the plants can be used by chemical manufacturers, who

will include recommendations regarding the extent of domestic manufacture, stock piles, prices, and the relations of the United States to the natural rubber areas of the Southwest Pacific.

Under the chairmanship of William L. Batt an inter-department committee is at work on this project, including representatives of State, Justice, War, and Navy Departments, and of RFC and FEA. Until the report of that committee has been received and considered both by the White House and by Congress, the present program of agent operation under RFC will continue. The rates of production will be determined by current needs, without regard to future policy or stock piles.

In a number of ways this rubber problem is typical of the various undertakings in which the United States tried to offset its shortage of strategic materials. Most of the other projects are in the field of minerals or exotic commodities like tea, coffee, and silk. The final decisions should waste no time in talking with the War Department and RFC.

An authority in the War Department estimates that about 20 percent of the investment in these plants represents steam generating facilities and other utilities and that an additional 10 percent covers equipment for nitric and sulphuric acid. There is a heavy investment in boilers, pumps, piping, valves, condensers, generators, wiring and evaporators. In view of the large total investment in the government-owned plants, engineers cannot afford to overlook the opportunities offered by the War Department.

OXYGEN AND ACETYLENE

Production of oxygen and acetylene soared during the war. Based on 1941 production, the output of each gas, last year, more than doubled, the increases for oxygen and acetylene being, respectively, 120 and 110 percent. Cutting and welding in the shipyards and in the steel shops absorbed the bulk of these gases. Neoprene rubber and chemicals had their share in the demand for acetylene. As for oxygen, in addition to its use in cutting and welding, much was used in hospital work and in high-flying planes.

An authority in WPB considers that the outlook for continued utilization of much of the present productive capacity is good. He stressed the fact that much of the prewar manufacturing capacity has been worn out through heavy usage and lack of repair and replacement.

A recent CED survey indicates that many new fields for acetylene developed during the war should be expanded. This gas is receiving much study. Information on German developments in safe handling of the gas under pressure is available, and may prove to be of value in this country.

LIGHT METALS

Increases in the primary production of the light metals since the beginning of the war have been great. Aluminum production last year was 150 percent higher than in 1941. The output of magnesium has risen prodigiously, the 1944 production being over ten times the annual production just before Pearl Harbor. Airplanes and bombs took the lion's share of these metals. Today RFC is ready to lease or sell practically all the government-owned plants.

The approach of the "light metals age" may help. Aviation is expanding. The foremost companies in the light metals field have the financial and technological resources to develop to the utmost the use of these metals. Competition that has arisen in the industry and increased productive capacity that has been built, both presage lowered prices and growing demand.

Principal Oxygen and Acetylene Plants

Planeer	Operator	Sponsor	Plant Location	Product	Approx. Annual Capacity, 1000 cu ft.	Approx. Government Investment, $1000
1239	Air Reduction Sales Co.	Maritime Comm.	Sparrows Point Md.	Oxygen	67,200	340
1244	Air Reduction Sales Co.	WPB	Emeryville, Calif.	Oxygen	60,000	170
1249	Air Reduction Sales Co.	WPB	Flint, Mich.	Oxygen	67,200	300
1250	Air Reduction Sales Co.	WPB	Brooklyn, N. Y.	Oxygen	134,400	570
1337	Air Reduction Sales Co.	WPB	Rochester, N. Y.	Oxygen	43,200	250
1338	Air Reduction Sales Co.	WPB	Milwaukee, Wis.	Oxygen	43,200	120
1339	Air Reduction Sales Co.	WPB	Lima, Ohio	Oxygen	28,900	90
1340	Air Reduction Sales Co.	WPB	Pascagoula, Miss.	Oxygen	67,200	370
1390	Air Reduction Sales Co.	WPB	Bettendorf, Iowa	Oxygen	67,200	290
1835	Air Reduction Sales Co.	WPB	Reading, Pa.	Oxygen	60,500	180
1172	Linde Air Products Co.	WPB	Kittanning, Pa.	Oxygen (liquid)	1,200,000	1,860
1223	Linde Air Products Co.	WPB	Essington, Pa.	Oxygen (liquid)	2,400,000	3,750
1660	Magnolia Airco Gas Products Co.	WPB	Houston, Tex.	Oxygen	67,200	280
1155	National Cylinder Gas Co	WPB	Brunswick, Ga.	Oxygen	93,600	210
1241	National Cylinder Gas Co.	WPB	Conshohocken, Pa.	Oxygen	31,200	80
1242	National Cylinder Gas Co.	WPB	Los Angeles, Calif.	Oxygen	46,800	80
1294	National Cylinder Gas Co.	WPB	Euclid, Ohio	Oxygen*	62,400	350
1809	National Cylinder Gas Co.	WPB	New Orleans, La.	Oxygen	16,800	30
1810	National Cylinder Gas Co.	WPB	McKees Rocks, Pa.	Oxygen	31,200	50
1925	National Cylinder Gas Co.	WPB	Evansville, Ind.	Oxygen	15,600	30
1062	Seattle Oxygen Co.	WPB	Seattle, Wash.	Oxygen	36,000	100
1201	Stuart Oxygen Co.	WPB	San Francisco, Calif.	Oxygen	46,100	370
1373	Air Reduction Sales Co.	WPB	Portland, Ore.	Acetylene	14,400	180
1400	Air Reduction Sales Co.	WPB	Baltimore, Md.	Acetylene	24,000	150
1401	Air Reduction Sales Co.	WPB	So. Baltimore, Md.	Acetylene	21,000	210
1607	National Carbide Corp.	RFC	Louisville, Ky.	Acetylene	500,000	650
1294	National Cylinder Gas Co.	WPB	Euclid, Ohio	Acetylene	60,000	†

* Also, capacity of 60,000,000 cu. ft. per year of acetylene gas. † Investment included in oxygen facilities at Euclid

Principal Alumina, Aluminum and Magnesium Plants

Planeer	Operator	Sponsor[6]	Plant Location	Product	Approx. Annual Capacity, 1000 lb.	Approx. Government Investment, $1000
226-X	Aluminum Co. of America	WPB	Harrison Creek, Ark.	Alumina	1,555,000	39,300
226-AO	Aluminum Co. of America	WPB	Baton Rouge, La.	Alumina	1,000,000	25,700
1831	Ancor Corp.	WPB	Harleyville, S. C.	Alumina	36,500	3,200
1865	Chemical Construction Co	WPB	Salem, Ore.	Alumina	36,000	4,300
291	Kalunite, Inc.	WPB	Salt Lake City, Utah	Alumina	72,000	4,900
1844	Monolith Portland Midwest Co	WPB	Laramie, Wyo.	Alumina	43,200	3,300
226-K	Aluminum Co. of America	WPB	Jones Mills, Ark.	Aluminum	128,000	29,300
226-A-4	Aluminum Co. of America	WPB	Riverbank, Calif.	Aluminum	96,000	11,600
226-LA	Aluminum Co. of America	WPB	Torrance, Calif.	Aluminum	100,000	24,000
226-A-3	Aluminum Co. of America	WPB	Burlington, N. J.	Aluminum	96,000	16,800
226-A-1	Aluminum Co. of America	WPB	Maspeth (L.I.), N. Y.	Aluminum	256,000	32,600
226-NY	Aluminum Co. of America	WPB	Massena, N. Y.	Aluminum	96,000	19,100
226-O	Aluminum Co. of America	WPB	Troutdale, Ore.	Aluminum	128,000	15,900
226-S	Aluminum Co. of America.	WPB	Spokane, Wash.	Aluminum	192,000	22,300
245	Olin Industries, Inc.	WPB	Tacoma, Wash.	Aluminum	41,500	6 200
546	Ameo Magnesium Co.	AAF	Wingdale, N. Y.	Magnesium	10,000	7,000
201	Basic Magnesium Co.	AAF	Las Vegas, N. M.	Magnesium	112,000	130,000
244	Diamond Alkali Co.	AAF	Painesville, Ohio	Magnesium	36,000	14,600
81	Dow Chemical Corp.	AAF	Freeport, Tex.	Magnesium	18,000	8,200
243	Dow Magnesium Corp.	AAF	Velasco, Tex.	Magnesium	72,000	55,100
477	Dow Magnesium Corp.	AAF	Marysville, Mich.	Magnesium	72 000	38,400[1]
571	Electro Metallurgical Co.	AAF	Spokane, Wash.	Magnesium	48,000	16,100
449	Ford Motor Co.	AAF	River Rouge, Mich.	Magnesium	40,000	10,400
265	Int'l. Minerals & Chem. Co.	AAF	Austin, Tex.	Magnesium	24,000	18,400[2]
669	Magnesium Reduction Co.	AAF	Luckey, Ohio	Magnesium	10,000	4,700
264	Mathieson Alkali Works, Inc.	AAF	Lake Charles, La.	Magnesium[3]	84,000	48,600
547	New England Lime Co.	AAF	Canaan, Conn.	Magnesium[4]	10,000	4,800
707	Permanente Metals Corp.	AAF	Mantera, Calif.	Magnesium	20,000	6,200

[1] Includes $16,800,000 investment at Ludington, Mich., for cell feed facilities. [2] Includes $3,800,000 for cell feed preparation at Carlsbad, N. M. [3] Also chlorine production. [4] Also calcium metal production. [5] War Production Board or Army Air Forces.

Synthetic Ammonia Plants

Name	Operator	Plant Location	Approximate Annual Capacity, as Tons Nitrogen	Approximate Government Investment, $1000
Buckeye Ordnance Works	Allied Chemical	Ironton, Ohio	178,000[1]	38,000
Cactus Ordnance Works	Shell Oil	Dumas, Tex.	80,000[2]	26,000[2]
Dixie Ordnance Works	Commercial Solvents	Monroe, La.	50,000	17,000
Jayhawk Ordnance Works[7]	Military Chemical Works	Pittsburg, Kan.	128,000[3]	30,000
Missouri Ordnance Works	Hercules	Louisiana, Mo.	59,000	19,000
Morgantown Ordnance Works	Du Pont	Morgantown, W. Va.	220,000[4]	54,000
Ohio River Ordnance Works	Allied Chemical	Henderson, Ky.	60,000	15,000
Ozark Ordnance Works[7]	Lion Chemical	El Dorado, Ark.	131,000[5]	29,000
(WPB Sponsor; Planeer 667)	Mathieson Alkali Works	Lake Charles, La.	54,000[7]	14,000
TVA	TVA	Wilson Dam, Ala.	50,000[6]	10,000

[1] Includes nitrogen equivalent of 24,000 tons per month ammonium nitrate capacity in 70 to 80% water solution. Crystallization elsewhere. [2] For one unit. Original design was for three units with total ammonia equivalent to 135,000 tons per year nitrogen. [3] Includes nitrogen equivalent of 12,000 tons per month ammonium nitrate capacity in 70 to 80% water solution. Crystallization elsewhere. [4] Or 55,000 tons per year nitrogen and 48,000,000 gal. per year methanol. [5] Includes nitrogen equivalent of 10,000 tons per month ammonium nitrate capacity in 70 to 80% water solution. Crystallization elsewhere. [6] Includes ammonium nitrate crystals production. [7] Being operated for fertilizer manufacture under arrangement with Commodity Credit Corp.

will not be made on the basis of domestic operations primarily. They seem likely to rest altogether on Washington's wishes as to our international trade relations. For the present no one knows how those relations will be worked out, probably not even the President.

PETROLEUM FACILITIES

Of the billion dollars worth of new petroleum facilities built for the war program less than a third was financed by Uncle Sam. Hence the oil industry is little plagued by surplus property settlements. Nevertheless it must face the fact that about one-quarter of the aviation gasoline plants, having about one-seventh of the productive capacity, are now owned by the government.

It is expected that the surplus property officers will undertake to find either small companies now in the business or new organizations to take over and operate these as "independent" gasoline-making establishments. Thus the small business aspect is being considered. But the large number of big companies which are vigorously competitive already make this anti monopoly effort of small significance. Far more important is the question as to how much Uncle Sam can collect for the Treasury from the disposal of these plants.

More significant for chemical engineers is the problem of what to do with specialized facilities for processing petroleum. The toluol-making equipment is but one example, though probably the most important one for immediate settlement. There are several very large toluol-making plants owned by the government. It is obvious that there is no immediate market for so large a capacity of this important solvent, since the capacity of these few works is nearly 20 times the normal peace requirement for toluol in chemical industry. If these plants are to be used, they must be applied to the making of anti-knock components for gasoline or for the production of other fuel products.

SURPLUS TOLUOL

The urgency of this particular problem is greatly increased by the existence of several million gallons of surplus toluol which was originally destined for TNT manufacture. That inventory represents the requirement as solvent and chemical for a considerable period. Coke oven operators are much disturbed by the fact that this huge stock hangs over the market in a way that permits sale at any price which Uncle Sam chooses to take. They would like to have this surplus sold quickly at low prices, say eight or nine cents a gallon, which would permit its use in motor-fuel blending. The government would like to get a higher price, perhaps 15 cents a gallon, which would certainly be a fair figure if chemical and solvent users were the customers. No policy decisions had been reached up to mid September on this commodity question. And until that question is settled, it is obvious that the sale of the surplus plants is altogether out of the question.

INDUSTRY SURVEYS

More than a year ago some of the top staff of RFC anticipated present surplus propery problems. They decided that they needed for their guidance surveys of industrial conditions throughout the country in each of the more important lines of business where surplus plant capacity was going to be a responsibility for RFC. Surveys were started then on a dozen or more commodity groups. Very realistic and factual results are, therefore, available to the officers in charge of surplus property sales.

In these undertakings the government has called on outside experts for a number of the more difficult reviews. For example, the government has arranged with one of the better known chemical engineering firms to study the alumina properties owned by Uncle Sam. This study will determine what the government owns, how it can be operated, with what expectable result under different circumstances. Particular attention will be paid to the probable cost of alumina at these works.

Several comparable studies were made both by industry and by the government with respect to the several steel plants in western states. Those investigations were an essential preliminary of the negotiations in the disposal of the two big works which had been operated by U. S. Steel Corp. and by Kaiser. As one result a new contract with Kaiser provides for completion of the Fontana plant so that it can make a diversified line of products. The government is advancing the funds needed for that purpose as a part of a new loan arrangement. Thus far the future of the Geneva steel property has not been settled, but it is known that U. S. Steel will no longer operate it.

Uncle Sam is usually still his own banker when new funds are needed to make sur-

Synthetic Rubber, Butadiene and Styrene Plants

Plancor	Operator	Sponsor	Plant Location	Product	Approximate Annual Capacity, 1000 Tons[1]	Approximate Government Investment, $1000
678	Copolymer Corp.	RFC	Baton Rouge, La.	Rubber	30	7,500
1491	Dow Chemical Co.	RFC	Velasco, Tex.	Rubber	33[2]	2 700
625	Du Pont	RFC	Louisville, Ky.	Rubber	60[2]	43 000
127	Firestone Tire & Rubber Co.	RFC	Akron, Ohio	Rubber	30	6,500
1054	Firestone Tire & Rubber Co.	RFC	Lake Charles, La.	Rubber	60	13,700
577	General Tire & Rubber Co.	RFC	Baytown, Tex.	Rubber	30	7,800
128	B. F. Goodrich & Co.	RFC	Louisville, Ky.	Rubber	60	10,500
982	B. F. Goodrich & Co.	RFC	Borger, Tex.	Rubber	45	8,800
983 & 983A	Goodrich & Firestone Cos.	RFC	Port Neches, Tex.	Rubber	120	32 400
126	Goodyear Syn. Rubber Corp.	RFC	Akron, Ohio	Rubber	30	7,600
611 & 611A	Goodyear Syn. & U. S. Rubber Cos.	RFC	Los Angeles, Calif.	Rubber	90	18,000
988	Goodyear Syn. Rubber Corp.	RFC	Houston, Tex.	Rubber	60	13,000
1083	Humble Oil & Ref. Co.	RFC	Baytown, Tex.	Rubber	30[4]	25,900
1278	National Syn. Rubber Corp.	RFC	Louisville, Ky.	Rubber	30	7 200
572	Std. Oil Co. of New Jersey	RFC	Baton Rouge, La.	Rubber	3[3]	26,000
130	United States Rubber Co.	RFC	Naugatuck, Conn.	Rubber	30	8,900
980	United States Rubber Co.	RFC	Institute, W. Va.	Rubber	90	18,300
279	Carbide & Carbon Chem. Corp.	RFC	Institute, W. Va.	Butadiene	80	38 800
1207	Carbide & Carbon Chem. Corp.	RFC	Louisville, Ky.	Butadiene	60	35,000
706	Cities Service Ref. Corp.	RFC	Lake Charles, La.	Butadiene	85	17 000
485	Humble Oil & Ref. Corp.	RFC	Baytown, Tex.	Butadiene	30	12,900
1518	Humble Oil & Ref. Corp.	RFC	Ingleside, Tex.	Butadiene	13	4,100
483	Koppers Co.	RFC	Kobuta (Monaca), Pa.	Butadiene	80	60,000
933	Neches Butane Products Co.	RFC	Port Neches, Tex.	Butadiene	100	56,500
484	Phillips Petroleum Co.	RFC	Borger, Tex.	Butadiene	45	35 000
943	Shell Union Oil Corp.	RFC	Torrance, Calif.	Butadiene	30	18 900
1063	Sinclair Rubber, Inc.	RFC	Houston, Tex.	Butadiene	50	30,900
1187	Southern Calif. Gas Co.	RFC	Los Angeles, Calif.	Butadiene	25	11,500
1593	Std. Oil Co. of California	RFC	El Segundo, Calif.	Butadiene	18	7 900
153 & 1365	Std. Oil Co. of New Jersey	RFC	Baton Rouge, La.	Butadiene	22	11,300
1365	Sun Oil Co.	RFC	Toledo, Ohio	Butadiene	15	7,100
1055	Carbide & Carbon Chem. Corp.	RFC	Institute, W. Va.	Styrene	25	9,800
929	Dow Chemical Co.	WPB	Los Angeles, Calif.	Styrene	25	13,100
930	Dow Chemical Co.	RFC	Velasco, Tex.	Styrene	50	17,900
483	Koppers Co.	RFC	Kobuta (Monaca), Pa.	Styrene	38	[5]
214 & 1129	Monsanto Chemical Co.	RFC	Texas City, Tex.	Styrene	50	19,700

[1] Long tons for rubber; short tons for butadiene and styrene. [2] Thiokol. [3] Neoprene. [4] Butyl. [5] Included in Koppers investment shown for butadiene.

SYNTHETIC RUBBER

Rubber plants and facilities for manufacturing raw materials, notably butadiene and styrene, are unlikely to be a drug on the market for some time to come. Forecasts of continued heavy demand for rubber during the next few years, reports of deterioration in the Pacific rubber plantations, and the need for continued large-scale development work in the synthetic rubber field lead to this conclusion. By the same token it is expected that the bulk of the capacity of nine government-owned carbon black plants will remain in operation.

Manufacturing costs of synthetic rubber should decrease through technological improvements. The rubber is competitive with the natural product. In some respects in performance it is superior to natural. The synthetic material is receiving intensive study. Ultimately, improved quality and lowered costs may well bring about in the field of rubber the displacement of natural products which has occurred elsewhere in the realm of synthesis.

plus property usable. In some cases very large new loans are being arranged, as in the case of the Fontana steel plant. More frequently the government is limiting the new money invested more severely. As one surplus officer said recently, "We do not mind spending a few hundred thousand on a multi-million dollar plant; but we do not propose to spend millions merely to salvage a few hundred thousand."

The terms under which new loans are being made vary widely. Almost any sort of a loan contract which has previously been applied during depression or war periods can still be negotiated. When the government retains the title under a lease, the new money is usually government money. However, a private enterprise desiring to use its own funds will generally be given permission to retain the title to the new construction which it installs, and to remove these facilities later, should such lessee not become owner.

When a new lease and purchasing contract is made with a company, the government includes a loan of needed new money in the terms of settlement for the purchase money. But it prefers that such lessee-purchaser use commercial funds if they are available. However, such funds are necessarily borrowed with the understanding that government money takes precedence over private loans in the settlement of the company's affairs if there be default or bankruptcy. And under these circumstances it is often difficult for a firm to borrow funds which otherwise would be very readily available to it. The government is, therefore, forced to become virtually a commercial banker as it was for many depression period transactions.

Furnace building in a plant for the production of calcium carbide at Ashtabula, Ohio, listed among the surplus property

As this report is written the whole surplus property organization is undergoing change. Congress has passed the act requested by the President, to substitute a single Administrator for the three-man Surplus Property Board. It is expected that this will result in relatively little change in the disposal program, so far as individual negotiations are concerned. But it will permit quick, vigorous action by the new administrator. And it will give the active disposal agencies prompt support with either rulings or contract closings, a promptness which has been sadly lacking during the interim between V-J Day and the induction of the new administrator.

RFC says categorically that it wants an opportunity to discuss the sale or lease of any of the government's plants. Some of these, particularly the synthetic rubber plants, are still being operated by the original lessees, but RFC is ready to discuss all properties. This reflects the fact that tenures on many of the presently retained facilities are expected to be short. It is also a reflection of RFC's anxiety to arrange for plant disposal as far in advance as possible, in order to avert idleness of facilities and unemployment when lessees relinquish their rights.

The tables of government-owned plants herein presented show selected groups that are important from the standpoint of investment. The lists within any particular group are substantially complete, although they do not include a few minor projects which are largely unfinished and which have but slight government investments.

OBJECTIVES OF SURPLUS PROPERTY ACT

The Surplus Property Act enumerates twenty objectives to be accomplished. They are:

1. **To give maximum aid in the establishment of a peacetime economy of free, independent, private enterprise;**
2. **To facilitate transition from war to peacetime production;**
3. **To discourage monopoly and strengthen position of small business;**
4. **To encourage and foster employment opportunities;**
5. **To discourage speculation;**
6. **To establish and develop foreign markets;**
7. **To avoid dislocations of the domestic economy;**
8. **To prevent excessive profits being made out of surplus property;**
9. **To dispose of the property promptly;**
10. **To obtain as nearly as possible the fair value of the property disposed of;**
11. **To assure effective use of such property for war and defense;**
12. **To foster and to render more secure family-type farming;**
13. **To afford veterans an opportunity to establish themselves in business;**
14. **To foster distribution of surplus commodities at fair prices;**
15. **To effect broad and equitable distribution of surplus property;**
16. **To achieve full utilization of surplus property at fair prices;**
17. **To utilize normal channels of trade and commerce;**
18. **To promote production, employment, and utilization of productive capacity and natural and agricultural resources of the country;**
19. **To foster the development of new independent enterprise; and**
20. **To dispose of surplus government-owned transportation facilities.**

Reprints of this report are available at 25 cents per copy. Address the Editorial Department, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

E. K. METZNER *Consulting Chemical Engineer, Los Angeles, Calif.*

GRAPE POMACE

A Source of Alcohol and Tartrates

Only since 1942 has grape pomace from wineries been treated on an industrial scale in this country to recover badly needed tartrates and alcohol. The continuous extraction process described herein, now with some half-dozen units in operation, represents the first successful large-scale technique to recover some of the $4,000,000 worth of chemicals now being discarded in pomace annually by California wineries.—*Editors*

ONE ILLUSTRATION of a long-neglected waste is the pomace piles of the wine industry. Only of late, through the combined efforts of far-sighted and conservation-minded government agencies and individuals, has the wine industry been made fully cognizant of the potential values this waste product contains. This article is intended to outline a process of waste recovery (U. S. Patent 2,359,929; other patents pending) developed by the author in the early years of the war, which has proved to be both economically and technologically sound. Some half-dozen units are now in operation to recover valuable materials in waste pomace.

Objectives that led to the design of this particular process were (1) to simplify the present method of handling and removing pomace from the fermenters; (2) to avoid unnecessary time loss and additional processing or handling of the pomace; (3) to reduce to a minimum, labor requirements for pomace processing; (4) to work out the most efficient and economic means to recover useful materials.

Average crush by the California wine industry amounts to approximately 800,000 tons annually. Of this total quantity, about 600,000 tons are used for the production of dessert (sweet) wine and about 200,000 tons for table (dry) wine. These tonnages of crush represent approximately 60,000 tons of dessert wine pomace and 20,000 tons of table wine pomace.

On the basis of 28 samples of discarded pomace from several wineries, it has been found that pressed table wine pomace averages about 4.0 percent potassium bitartrate and 5.0 percent alcohol and that washed and pressed dessert wine pomace averages close to 1.6 percent bitartrate and 2.0 percent alcohol. Hence, the pomace discarded annually by the California wine industry contains some 1,800 tons of recoverable bitartrate and 1,333,000 proof gal. of alcohol. Based on present market prices, these figures represent an annual loss to the wine industry of over $4,000,000. Even though a recovery program has been under way for several years, the loss is still large as less than 5 percent of the total tartrate and alcohol in pomace is now being recovered.

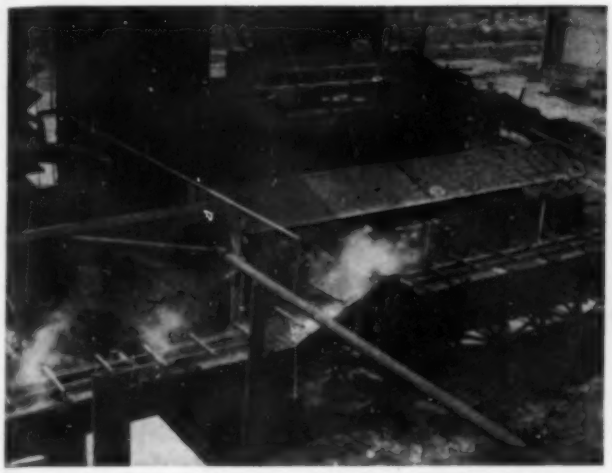
PROCESS DESCRIPTION

As shown in the accompanying flowsheet, the pomace is removed from the fermenters after complete fermentation of all available sugars and is conveyed directly to the de-alcoholizer to recover the residual alcohol. The de-alcoholizer discharges pomace into the tartrate extractor from where it is discharged into a washing battery to remove the adhering tartrate solution. A continuous press on the discharge end of the washing battery removes excess moisture; the pomace is then conveyed to the stock pile free of alcohol and tartrates.

Tartrate solution, discharging from the tartrate extractor, is pumped to settling tanks where carry-over solids are settled out. The supernatant liquid is transferred into a precipitating tank where, by the addition

Waste pomace causes annual loss of $4,000,000

Pomace feed to the Metzner extraction process



Tartrate extraction unit and precipitation tanks

Discharging spent Pomace from the washing battery

of $CaCl_2$ and lime, the tartrates in solution are precipitated as calcium tartrate. After washing, the tartrate precipitate is conveyed to a dryer and from there is bagged for shipment (See *Chem. & Met.*, Sept. 1945, pp. 116-9).

Upon entering the de-alcoholizer, the pomace is subjected to a steaming operation which serves to condition the pomace for the subsequent extraction of tartrates, and to vaporize completely all alcohol present. Vapors from the de-alcoholizer are collected as a low-proof condensate averaging from 10-20 percent alcohol, depending upon the initial concentration of alcohol in the pomace.

Water used for condensing the alcoholic vapors from the steaming operation is used as wash water in the washing battery; this is the only water used in the entire process. Thus, the heat spent for the recovery of the alcohol is utilized in the extraction of the tartrates. In many cases no additional heat is required.

Hot water from the condenser entering the discharge end of the washing battery travels counterflow to the pomace into the tartrate extractors where, at a given point, the concentrated tartrate solution is continuously drawn off in such a way as to insure a constant liquid level. This constant level is desired since the discharge of the de-alcoholizer is liquid-sealed by means of a submerged spout to prevent the escape of any alcoholic vapors. To insure the sealing of the feed end of the de-alcoholizer, arrangements are made so that the entering pomace provides a tight seal, thus forcing all alcoholic vapors to enter the condenser.

CONTINUOUS OPERATION

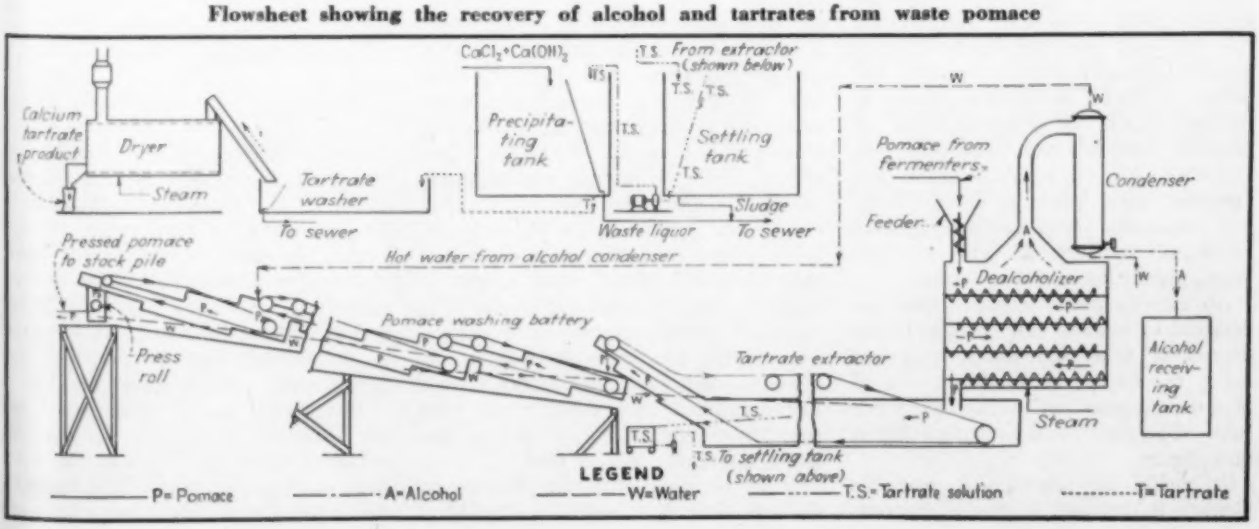
Flow of the pomace through the de-alcoholizer, tartrate extractor and washing battery to the pomace pile is continuous. Fluctuations in the amount of pomace from the fermenters do not affect the operation of the tartrate-alcohol plant, since arrangements are incorporated which compensate for such irregularities in the feed.

Direct evaporation of the alcohol in the pomace eliminates the necessity of pressing the pomace before it enters the process. The one possible exception is in the production of dry wines, where it may be desired to press the pomace for the recovery of press wine to be used for beverage purposes. However, in sweet wine production where the pomace has been subjected to a secondary fermentation, pressing the pomace would be an unnecessary operation. It is also unnecessary to further wash the pomace since all alcohol is recovered directly by evaporation.

After extraction of alcohol and tartrate, the pomace has an increased value both for use as fertilizer and for cattle feed. Extracted pomace, freed of all injurious acids and alcohol and sterilized during the extraction process, decomposes far more readily than untreated pomace, is not injurious to plant life and becomes a valuable soil builder and fertilizer. If dried immediately after the extraction, tartrate-free pomace becomes more digestible and may well be used as a cattle feed. Thus the process represents an economical way in which to recover alcohol and tartrates and at the same time to increase the value of the pomace.

The author wishes to express his appreciation to the American Cream of Tartar Division of Stauffer Chemical Co., the University of California and to the many individuals in the wine industry, for cooperation in making this process a success.

Flowsheet showing the recovery of alcohol and tartrates from waste pomace



RALPH M. HUNTER *The Dow Chemical Co., Midland, Mich.*

GERMAN CHLORINE

A Report on Production Methods

Engineering data on the construction and operation of German electrolytic chlorine plants, especially their mercury cells, have been anxiously awaited by the U. S. chlorine industry. At last the details are available. They come in the form of an American observer's report on his investigation of a cross section of Germany's production facilities. Six plants, totaling more than a million pounds of chlorine daily, were visited and inspected.—*Editors*

When an investigation of the chlorine industry of Germany is made, one is immediately impressed with the fact that since 1936 all new chlorine installations have been made in the mercury-type cell and that many older Billiter installations have been dismantled and displaced, or used as stand-by, or operated merely to make up the peak chlorine demand. Of the installations inspected by the author, all six were using mercury cells and only two had Billiter cells as auxiliary capacity. The mercury cell plants are those of Wacker Werke at Burghausen; I. G. Farbenindustrie at Gendorf, Bitterfeld and Gersthofen; Kali Chemische A. G. at Zscherndorf; and Deutsche Solvay Werke at Osternienberg. The Billiter-cell plants are those operated by I. G. at Bitterfeld and Wacker's small installation at Burghausen.

All chlorine plants inspected were undamaged by bombs. The cells had been drained of brine and the mercury was being circulated. A small number of men were dismantling and cleaning a few cells. Operation could be started almost immediately.

It should be pointed out that the German Billiter cell, if present remnants may be considered typical, is a poor cell by American standards. Its power requirements are in excess of 1.5 kwh. per lb. of chlorine, a figure which is generally met by the mercury cell. Its floor space requirement is very large, and while the maintenance is probably less than that required for the mercury cell, the quality of its product is far inferior. In addition, there is evidence that mercury was very cheap in Germany in 1936, probably due to a political connection with Spain.

MERCURY CELLS

The following description of mercury cells may be considered to be a composite of the cells seen. They are usually about 25 in. wide. The length varies from 40 ft. on the Kali Chemische Co.'s cell, which operates at almost 20,000 amp., to the 20-ft. I. G. cell at Gersthofen, which operates at 14,500 amp. In general, it may be said that about 25 ft. and 15,000 amp. are preferred. It was reported that the Leverkusen cell, which was the latest type, was 45 ft. long and operated at 22,000 amp.

Cell tanks are composed of steel and are about 8 in. deep. The side members which are used for stiffening extend below the cell bottom and support the cell on insulators. With one exception, cell sides are lined with rubber ¼ in. thick, which is folded over onto the bottom, making a mercury path about 22 in. wide. In most cases the bottom is bare and is properly sloped to give perfect mercury distribution. However, examination of several open cells in which the mercury was being distributed revealed that mercury distribution is not perfect, a few exposed iron spots being visible, though it was stated that these are covered when current is applied. In a few installations the bottoms are partially covered with rubber, leaving bare iron spots about 8 in. in diameter, but this construction is not highly regarded since difficulty has been experienced with mercury getting between the rubber and the steel.

It is necessary that the bottom be flat and there is a possibility that hand grinding of the bottom may be required to level off high spots. The slope given the flat bottom is regulated to conform to the rate of flow desired for the mercury. The tank described is considered to be the electrolyzer part of the cell in which chlorine is liberated on the anode and mercury amalgam is produced at the cathode. The amalgam flows into a stripping chamber, or "piela," placed beside the electrolyzing chamber. Size and shape of the piela vary, but the most popular is about 10 in. square and of the same length as the electrolyzer. It is placed horizontally beside the electrolyzer.

No attempts to recover voltage by using the decomposition of the amalgam in series with the electrolyzer were seen. A graphite grid inserted along the full length of the piela dips into the mercury and assists in depolarizing it. The shape and design of the grids vary, but they are all composed of graphite and are all about 3 in. deep.

An exception to the rubber-lined cell was observed at the Solvay Werke at Osternienberg, where the steel tanks are lined with glass and brick on the sides to accomplish the same results. These cells are apparently operated at low temperatures and low current density and appear to be of older design.

THE Hg CYCLE

Mercury pumps are universally of the type illustrated. The pump used at the Wacker Werke is rated at 400 kg. per min. and consists of a rotating, tapered sleeve, 12 in. long, 6 in. in diameter at the top and about 3 in. at the bottom. Two small vanes welded to the inside of the tapered sleeve throw the mercury upward as the hollow sleeve is rotated at 440 rpm. on the vertical shaft carried by the motor. The mercury flow rates given, which are probably the ratings of the pump, in all cases exceed the rate necessary to produce a 0.2-percent sodium amalgam. (This was the figure given in all cases except I. G., Gersthofen, which claims to operate at low voltage and

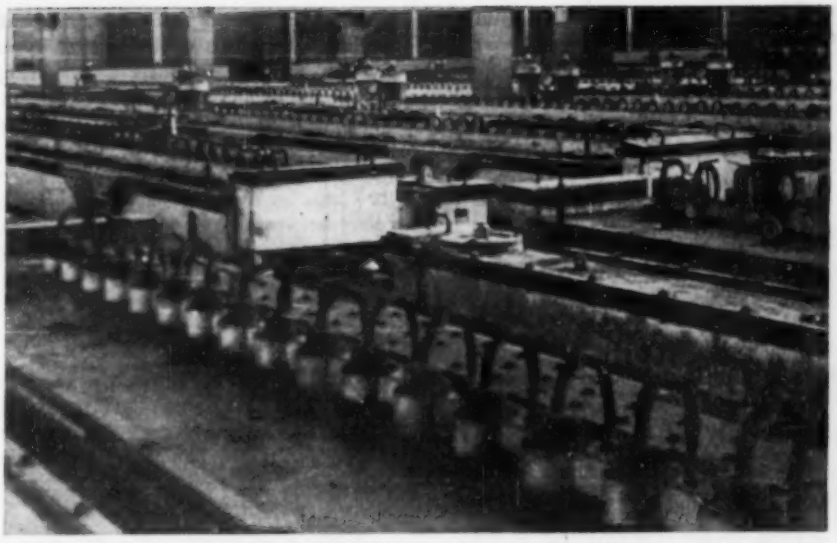
an amalgam limited to 0.15 percent from the electrolyzer with a stripping concentration of 0.01 percent.) Flow through the electrolyzer is brought to 0.2 percent Na and discharged with weakened brine through a trap. In this trap the amalgam and the brine are separated, the former going to the adjacent piela. The depth of the mercury film flowing over the bottom of the electrolyzer is about 0.08 to 0.16 in. and its rate of flow at Bitterfeld is stated to be 5½ in. per sec.

In the piela pure water is fed in at the pump end, passing countercurrent across the surface of the decomposing mercury to be discharged at the trap end, usually in the form of a 50-percent caustic solution. The Solvay Werke cells discharge a 45-percent solution and it was claimed at Kali Chemische at Zscherndorf that experimental operation had produced 75-percent caustic, although the source of information in the latter plant proved to be very unreliable when figures were checked.

The amount of mercury used in the cell is shown in the accompanying table. Figures on mercury losses were not consistent. It was generally admitted that the hydrogen must first be scrubbed and cooled completely to keep mercury losses down. The highest loss was 7 percent of the mercury per year (at the Wacker Werke) and most of this loss was attributed to solubility in the caustic soda. At Gendorf it was thought to have been between 4 and 6 percent; Bitterfeld claimed 4 percent and Kali, 1 percent.

ELECTROLYTE AND ELECTRODES

Brine fed to mercury cells must be free from sulphates and salts of magnesium. At the Wacker Werke the salt is dissolved in rubber- or brick-lined steel tanks equipped with a rubber-covered agitator. Hot weak brine from the cells at 250 gm. of sodium chloride per liter is returned to the tanks and fresh water for makeup is added. The solution takes place at about 60 deg. C. Sodium carbonate is added to remove calcium, NaOH to remove magnesium, and barium chloride to remove all traces of sulphate. The brine is then put through a filter press and is ready for the cells.



Hg cells in I.G. plant at Gersthofen. Note rectangular shaped "piela"

The above system seemed to be universal throughout Germany, and it was obvious that while Billiter cells were operated with brine containing sulphate, the purification step was necessary for all mercury cells. The brine is fed to the cells at about 50 deg. C. at 310 gm. NaCl per l.; it is discharged at from 220 to 270 gm. per l., depending upon the theories of the operator. It was claimed at Bitterfeld that 270 is preferred and that 230 causes high graphite consumption and high voltage. The discharge strength of some of the brines is controlled by the temperature. At one plant brine was fed at a rate calculated to maintain 80 deg. C. in the electrolyzer. It was stated that, in general, cells with new graphite operate at about 70 deg. C. and with old graphite at about 90 deg. The temperature in the piela varies between 75 deg. C. in low-current-density cells and 100 deg. C. in high-density cells.

The experiment with 75-percent caustic called for piela temperatures above 110 deg. C., which was obtained by insulating the piela. No detrimental effects had been observed, except that it was difficult to strip the amalgam to 0.02 percent sodium.

Anodes all consist of unimpregnated graphite, spaced, when new, about ¼ in. above the mercury. In general, they are about 2½ in. thick and are spaced to cover the mercury surface as completely as possible. A popular size was 2½x7x25 in. To facilitate chlorine evolution on the flat, horizontal anode, saw cuts were made up through the bottom to a depth of about 1½ in. These saw cuts enlarged greatly on a worn electrode, which was usually discarded about the time the graphite wear had receded to the depth of the saw cut. The life of American graphite is usually 300 days and of German about 225. The graphite anodes are usually supported on one or two leads much in the manner of the illustrated Billiter cell. These leads go through, and are supported by, the covers which apparently have been made of sandstone slabs until recently. There now seems to be a trend toward rubber-lined steel covers and these are used when obtainable. Rubber on these covers, and in the cells, will last about three years if the percentage of natural rubber is high. Buna gives about two years life.

Since the steel electrolyzer tank is the cathode connector to the mercury, bus bars are taken from it at several points to the adjacent cell where the power is distributed by means of a bar placed on the top of the electrolyzer at the side near the piela. Short connectors are used between this anode bus and the graphite anode leads. Switching arrangements are provided be-

Operating Characteristics of Six German Electrolytic Chlorine Plants

Place and Company	Burghausen Wacker		Bitterfeld I.G.		Osterniemberg Solvay	Gersthofen I.G.	Gendorf I.G.	Zscherndorf Kali Chem.
Type of cell	Mercury	Billiter	Mercury	Billiter	Mercury	Mercury	Mercury	Mercury
Production, lb. Cl_2 per day	49,000	39,000	200,000	240,000	66,000	140,000	250,000	85,000
Amp. per cell	15,000	6,000	15,000	10,000	10,000	14,500	16,500	19,500
Volts per cell	4.4-5.0	5.0	4.5-5.0	4.5	4.3	4.2-4.4	4.5-5.0	4.3-5.0
Amp. efficiency	.....	.....	95.0	94.0	.....	95.0	.....	96.0
Kwh. per lb. Cl_2	1.7	1.82	1.67-1.85	1.67	1.65	1.58	1.82	1.6-1.85
Lb. graphite per 2,000 lb. Cl_2	.....	.....	6.7	9.0	7.5	5.8	6.0	8.0
Man-hr. per 2,000 lb. Cl_2	2.0	2.4	3.0	3.2	.....	4.3	2.7	1.9
Electrolyzer size	25 in. x 36 ft.	4 ft. x 18 ft.	27 in. x 26 ft.	10 ft. x 18 ft.	25 in. x 40 ft.	28 in. x 30 ft.	27 in. x 23 ft.	23 in. x 40 ft.
Bldg. for cells, sq. ft. per 2,000 lb. Cl_2 per day	640	.....	560	1,200	.....	600	460	440
Anode cur. density, amp. per sq. in.	2.1	0.9	1.4-2.0	1.25	2.1	2.4	2.3	1.75
Lb. Hg in cell per lb. of Cl_2	1.82	.....	1.8	.....	2.7	1.42	.....	1.78
Hg loss, percent per year	7	.....	4	.....	.....	.....	4-6	1

tween each cell to permit shorting out and cleaning, which is done about every three months. During these shutdown periods the mercury is removed, the cell thoroughly cleaned, and the anodes removed or readjusted.

CHLORINE

Chlorine from the mercury cells is usually collected at very low suction or a slight back pressure. It usually contains very little air, but carries 1-1½ percent carbon dioxide. Hydrogen formation averages between ¼ and 1 percent for the entire plant, but may run as high as 2 percent on individual cells.

Chlorine cooling is usually accomplished by passing the gas through stoneware coils which are cooled by water sprays, or by passing the gas countercurrent to water in direct contact through Raschig ring-filled towers which may be of ceramic- or brick-lined steel.

Drying is done in three or four towers in series through which sulphuric acid is circulated. Concentrated sulphuric, usually about 96-percent, is put into the strong acid towers; concentration of the weak, discharged acid is 50 percent if three towers are used and 38 percent on some four-tower systems. In most plants the strong acid is fed continuously at a low rate into the strong tower, overflowing by gravity into other towers.

Chlorine liquefaction is usually accomplished by compressing the gas to above seven atmospheres and cooling the compressed gas with water. At 7 atm. compression two-stage compressors are used. Compressors are universally sulphuric acid-lubricated and have vertical shafts. As is common in Germany, there is a tendency to put the cylinders in tandem. The injection of liquid chlorine for cooling purposes between stages is rather common.

A machine used at Gendorf compresses to 7 atm. in two stages and has a water cooler between stages. It is rated at 500 cu. m. per hr. at 120 rpm., 1.2-ft. stroke, 1.8-ft. dia. first-stage cylinder, and 0.85-ft. second-stage cylinder. The cylinders are in tandem and in one casting. Although the crank is below the vertical cylinders, two rods and a yoke place the piston rod above the cylinders so that the graphitized asbestos packing on the first stage is on the top. The cylinders are plunger type and the pistons are made from a single casting. A 30-kw. motor drives the compressor.

A four-stage machine was inspected at Zscherndorf. This originally compressed 25 tons of chlorine per day but after two years fell off to 18 tons. Although four stages of compression are used, water cooling was done only after the second. Six cylinders are used (two first-stage, two second-stage, one third, and one fourth). It operates at 80 rpm. and has a 24-in. vertical stroke, two piston rods and three cylinders per rod. The first-stage cylinders, 23-in. in diam. are at the crank end of the rod; the rod entering them is packed with graphitized asbestos, lubricated with sulphuric acid. The other cylinders are in tandem with the first and separated from each other by iron rings. Each assembly of cylinder blocks is machined from a single casting. By this design only one packing per rod is used, and the leakage from a higher stage is caught in the adjacent lower stage. Each cylinder and packing are separately lubricated with sulphuric acid through a valve-regulated dropper.

Economic Data on German Chlorine Production

Costs of materials (in marks) as of May 1945:	
Graphite, per lb.	0.33
Salt, per metric ton	20
Mercury, per lb.	*3.4
Labor, per hr.	†0.65–0.8
Cost of plant construction, including bldgs. and cells (in marks per lb. Cl_2 capacity per day):	
Gendorf, a large plant	31
Gersthofen, a small plant	45
Cost of hydroelectric power (in marks per kwh.) in Burghausen area:	
Old plants which have written off amortization and interest	0.008
System power, mostly new plants	0.023
Estimated cost of power from *Braunkohle* in Bitterfeld	0.010
Over-all cost (in marks) of producing 47kg. Cl_2 plus 53kg. NaOH:	
I.G., Gersthofen, including amortization and interest	9
I.G., Gendorf, not including amortization and interest	9–12
Wacker, Burghausen, including amortization and interest	7–8

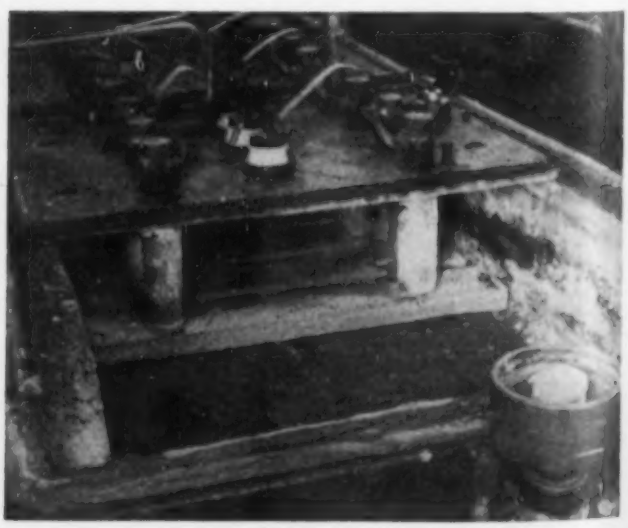
* Price in 1938 was 2 marks per lb.
†Depending on skill; 50- to 60-hr. week.

BILLITER CELLS

The Billiter-cell plant at Bitterfeld consists of 352 cells rated at 10,000 amp. and 192 in Wolfen rated at 5,000 amp. Feed brine is prepared in a manner similar to that of the mercury cells, except that sulphates are permitted to remain and are as high as 6 gm. of Na_2SO_4 per l. The 10,000-amp. cells operate at 4.5 v. per cell, 94-percent current efficiency, and 1.67 kwh. per lb. of chlorine. The effluent contains between 110 and 140 gm. of NaOH per l. and about 0.125 gm. of $NaClO_3$ per l. The cathode current density was designed at 0.65 amp. per sq.in. Graphite consumption, with German graphite, is 4.5 lb. per 1,000 lb. of chlorine. Anode gas analyzes 98 percent chlorine, 0.1 percent hydrogen and 1 percent air.

Cells are the horizontal, diaphragm type

(*Continued on page 112*)



Wacker Werke, Burghausen. Left—Mercury cells and closeup of Hg pump. Below—Closeup of Billiter cell (6,000-amp. size) with one anode-set removed

Instrument Type Speed Control Used on Ammonia Plant Compressors

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Cooper-Bessemer Corp., Mount Vernon, Ohio

AN IMPRESSIVE reminder of the power behind the explosives program that blew the Axis out of the war may be seen in the Lion Oil Refining Co.'s Ozark Ordnance Works, at Eldorado, Ark. There, serving the Works' ammonia plant, is an installation of 24 Cooper-Bessemer 10-cylinder, 1,000-hp., V-angle Type G-MV compressor units, with multi-stage compressor cylinders. This total of 24,000 hp., powered by gas-fueled engines, is under control of an interesting system of interlocked instruments that permits either manual or automatic control. Conventional governors are not used to regulate engine speed. Instead, a system that is probably used only by Cooper-Bessemer among the compressor manufacturers is employed, operating on practically the same principles that are often used for steam turbine and electric generator regulation. Patents are held by the company on some of the design features.

While automatic control of compressor engines is usually accomplished by conventional governors (and is entirely satisfactory where the engine torque requirements are comparatively constant, with speed variation of 50 percent of full load speed or less), in the case of installations such as that for an ammonia plant, requiring continuous stable operation of the compressors, matching process demand, under various torque conditions and over a wide speed range, the "exact rate governor" type of speed control described here is necessary. This system has been used for the past five years in chemical and petroleum industries, there being four installations somewhat similar to this with from one to 21 compressor engines so controlled in each plant.

CONTROL FLEXIBILITY

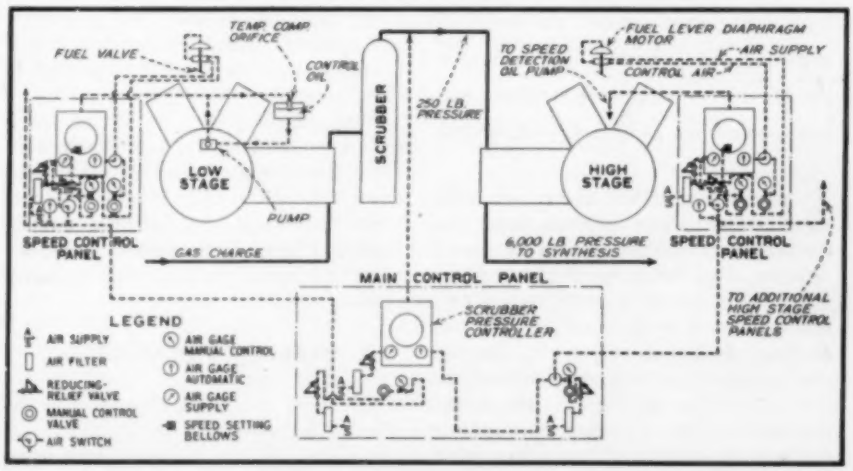
The control system permits one or more engines to be stopped or started as desired without upsetting the over-all regulation. Thus, as compressors are removed from service the engines of the remaining units automatically speed up to carry the load. The provision of means for manual control greatly facilitates starting. The automatic features have several advantages over a governor. For example, control is within ±1 percent of the chart range and there is no appreciable "dead zone" in which no correction can occur. The rate of fuel correction after a speed deviation is not fixed but is always proportional to the rate of deviation. Furthermore, the instrument adjustments permit the rate of correction to be adjusted more accurately to the individual engines.

There are two principal parts to the control system: the individual engine-speed detecting and control units, one of which is provided for each compressor engine; and the two master control panels, one for each of the two groups of 12 compressors. These latter are responsive to the compressed gas delivery rate of the entire system and serve to reset the individual engine controllers of the 12 high-stage compressors, thus controlling the system output. It should be explained at this point that, as shown in the diagram, there is one 6,000-lb. high-stage compressor for each 250-lb. low-stage compressor. They are not, however, connected directly in pairs as the drawing suggests, but are connected through the scrubbers by a common main which draws from six of the low stage units and feeds six of the high stage units. Each group of 12 then receives its over-all control from one of the two master control boards, the control element of which responds to the high-stage suction pressure. It should also be pointed out that the resetting function of the two master controllers is applied only to the high-stage compressor engines. When alteration of the speed of the low-stage units is needed, this is accomplished manually and remotely for all low-stage compressors in each of the two groups by the manual control buttons on the master panels.

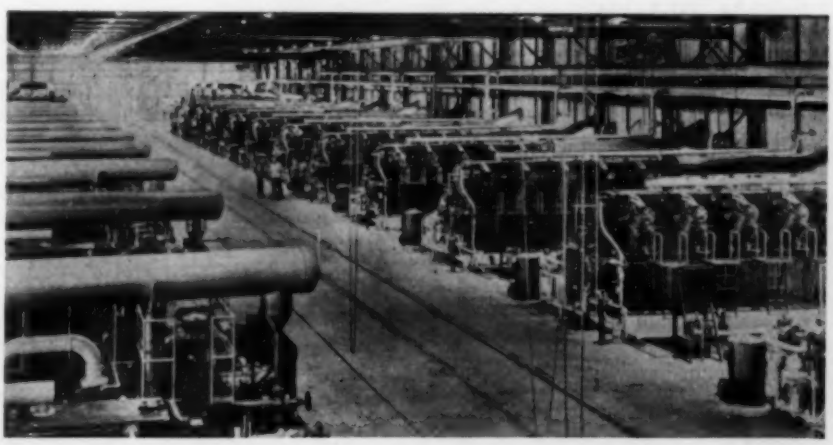
At each engine is an individual speed control panel. The instruments comprise a hydraulic pressure system responsive to the engine speed, which operates in conjunction with a standard pneumatic type pressure recorder-controller to adjust the engine fuel supply for constant speed maintenance. This instrument is provided with adjustable throttling range and automatic reset. To permit speed adjustments, its control point is set by a pneumatic bellows instead of a manual adjustment. Thus it can be used as a "ratio" pressure controller, since its control point can be made to vary automatically with another pressure or flow rate, through connection of its bellows to the output air of one of the two master panel controllers. However,

(*Continued on page 119*)

Diagram of control equipment for one high- and one low-stage compressor



Here are most of the 24 compressors in the Ozark ammonia plant



CHARLES W. PERRY *Chemical Engineer, Bartlesville, Okla.*

Analysis Determines Control Variables for DISTILLATION SYSTEMS

A rational method of analyzing process variables has been developed to aid in the application of automatic control to continuous distillation systems. Minimum control requirements may be readily determined by this method without the use of engineering approximations frequently necessary in this work. An effort is made to simplify the analysis of complex systems by applying this theoretical method to certain illustrative problems which are often encountered in practice.—*Editors*

Successful operation of continuous distillation systems depends largely on the correct analysis and control of process variables. Experience, however, has shown this to be a difficult type of analysis confronting chemical engineers operating or designing distillation equipment. For this reason, a considerable amount of work has been carried out during the past several years in an effort to develop more suitable methods for handling this problem. Outstanding, perhaps, is a theoretical method proposed by Gilliland & Reed (*Ind. Eng. Chem.*, 34, 551-7, 1942) which consists of a rigorously correct analysis (free of the usual simplifying approximations) of the degrees of freedom for multicomponent, multistage, interphase contact systems, based on Gibbs' phase rule and the fundamental laws of matter and energy. The practical value of this method is that it provides a clearer undestanding of still operation and aids in selecting control variables thus helping to prevent faulty instrumentation practice. The purpose of this discussion is to clarify the application of this theoretical method to the practical problems found in the automatic control of distillation processes.

Actual control technology has been pretty well established insofar as individual process variables are concerned and adequate instrumentation is available to satisfy most process requirements. A great deal of thought has been given to the problems resulting from the effects of matter or energy capacities, process lags and delayed responses in general on the ability of an instrument to maintain a fixed value for its specified variable whether this be pressure, temperature, flow, liquid level, etc., to the end that instruments have been developed to give precise control of most variables encountered. While the analysis of individual variables is well advanced, the equally important analysis for determining the minimum number of process variables which must be controlled for satisfactory still operation, should be the first step in the application of automatic control to these systems.

Although complete automatic control is seldom necessary for the operation of most distillation systems, theoretically, it is necessary that all independent variables be either "fixed" or controlled in a definite manner. Leaving a single independent variable uncontrolled results in a partially regulated system.

VARIABLES CLASSIFIED

Generally, independent variables in distillation processes may be separated into two classes: (a) the thermodynamic intensive variables governed by the phase rule (under equilibrium conditions) including temperature, pressure, concentration, specific gravities, etc., and (b) the flow or extensive variables consisting of the relative quantities of the streams of material and energy entering or leaving the system such as the ratio of gas feed to liquid feed, the ratio of net heat supplied to the liquid feed, etc. In the following analyses these variables under (b) are conveniently expressed as quantity ratios of which one quantity ratio has a reference value of unity. Actually, only a few of the many variables which might be present are independent but when these have been fixed, the remaining dependent variables in the system are also fixed under equilibrium conditions according to the phase rule.

For the purpose of automatic control, it makes no difference which of the independent variables are selected as long as the *total number of fixed or controlled variables is equal to the difference between the total number of independent variables and the total number of independent equations relating them* in accordance with the analysis developed by Gilliland and Reed. Mathematically this means arbitrarily fixing as constants a number of variables equal to the number of missing equations in a process described by a set of simultaneous equations.

FUNDAMENTAL BASIS

The equations relating the independent variables are derived from the laws of conservation of matter and energy and from the second law of thermodynamics. Briefly, if there are C independent components in the streams of liquid and vapor entering a stage, then C independent material balances may be written for the contacting unit. Equations may also be written for the enthalpy or heat balance and for the equilibrium relations which apply to the system.

In order to apply the phase rule to a vapor-liquid contacting system, equilibrium, or a fixed distance from it, must be assumed, since it is well known that in a bubble plate fractionator of conventional design, equilibrium is seldom attained on the plates. In the case of a reboiler, vapor and liquid usually have sufficiently good contact so that equilibrium may be assumed. In the following discussion each stage will be considered as a separate system with C components.

Absence of equilibrium in the liquid-vapor contacting stages of a fractionator necessitates assuming a fixed distance from equilibrium for each stage. For this analysis to hold it is assumed that each stage efficiency is a variable, and for m stages, m new variables must be fixed or controlled. This means that in multistage systems, for instance, the pressure drop across each plate in a column must be considered as a variable. Practically, however, if the pressure drop across the whole column is controlled, the drop across the individual

plates is automatically fixed under equilibrium conditions. It is obvious then that one instrument will, in effect, control all of the pressure variables in a fractionating column.

In the following examples where methods of control are discussed, only the broad classes of commercially available instruments are considered. Generally, the the application of particular types of controllers depends upon specific characteristics and requirements of the systems.

SINGLE STAGE CONTACTORS

This analysis will first be applied to a single stage vaporizer without a condenser in which equilibrium is assumed for a binary mixture as shown in Fig. 1. One liquid feed stream L_1 is provided and the vapor is vented to the atmosphere. It is desired to fix the composition and heat content of the exit streams. Heat, Q, is supplied by a closed heating coil. The number of independent variables is obtained by the equation: $(2C+1)$ thermodynamic intensive variables + 3 quantity ratios + 1 heat ratio Q/L_1 — 1 quantity ratio of unity — C material balances — 1 heat balance $= C + 3 = 5 =$ independent variables or degrees of freedom since in this case $C = 2$.

In order to establish fixed conditions, it is possible to: (a) Fix completely the composition and heat condition of the feed $= C + 1 = 3$ variables, (b) fix $Q/L_1 = 1$, and (c) fix pressure $= 1$, which sums up to the required number.

For the purposes of this illustration the composition and conditions of feed may be fixed by a premixing tank with a heating coil, on which a temperature controller operates. The ratio Q/L_1 may be fixed by controlling the flow in the liquid supply line and the heating fluid (steam) line. If it is desired to vary the feed rate, the ratio Q/L_1 may be held constant by using a ratio flow controller. Pressure can be fixed above atmospheric by a pressure relief valve venting to the atmosphere or if vacuum operation is desired, a vacuum pump can be applied, connected to a pressure controller.

Feed to the vaporizer may be by gravity from raised tanks, or by means of a pump. If a ratio flow controller is used to keep the ratio of Q/L_1 constant, this would operate a diaphragm valve in the heat supply line. Overflow of concentrate L_2 from the vaporizer can be controlled simply by placing a connection at the proper height with a liquid seal as shown in Fig. 1, if Q and L_1 are fixed, and operation is at atmospheric pressure. If vacuum operation is required, a pump pulling both concentrate and vapor out at a steady rate can be applied to maintain fixed pressure. In this case only the vapor pump enters into the analysis of variables, since with Q/L_1 fixed, and the composition and condition of L_1 fixed, L_2 is automatically fixed. The same would be true for pressure operation in which pressure would be fixed by a vapor relief valve working from a pressure controller or set spring, and L_2 would be discharged by a liquid level controller. It is frequently the case that such mechanical devices, which may all be grouped as automatic controls, may or may not enter into the analysis of variables, subject to the choice of the operator.

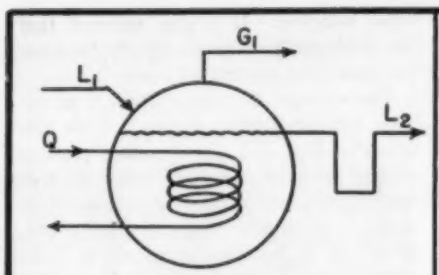


FIG. 1 - Single stage non-condensing still

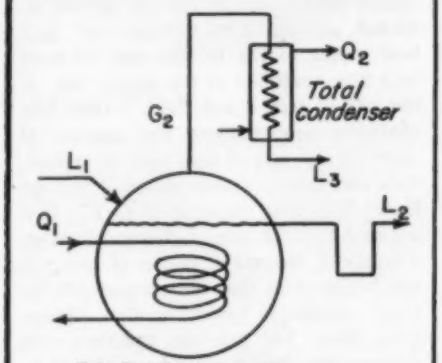


FIG. 2 - Single stage condensing still

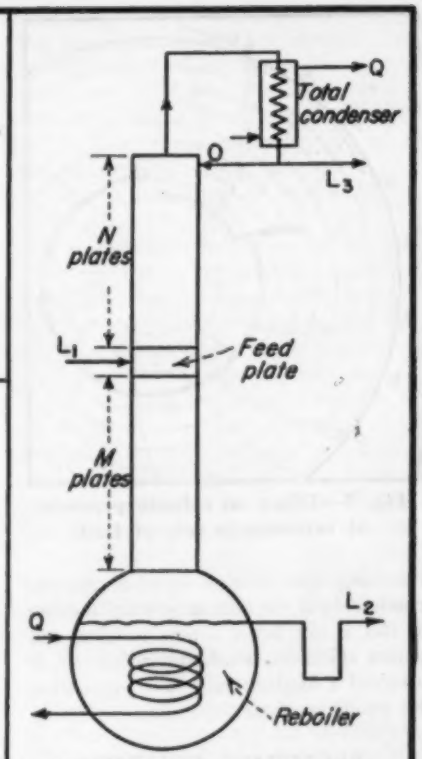


FIG. 3 - Rectifying column with reboiler and total condenser

Figs. 1, 2 and 3—Schematic views of typical contacting units

It is customary to subcool L_2 below the boiling point before discharging to storage. This can be accomplished by a heat exchanger equipped with a temperature controller and was not included in the variables from the preceding analysis, since it is external to the system.

The preceding method is one of several possible for this case. Temperature of liquid in the vaporizer might have been used rather than pressure as a fixed variable. Or both temperature and pressure might have been chosen and the feed composition allowed to vary. In each case the instrumentation would have been different. It is not possible to discuss all of the variations here, but rather to point out the principles involved.

MINIMUM CONTROL

Obviously, then, the number of independent variables is no criterion of the total number of instruments used. This analysis points out only the minimum number of independent variables for complete control. Getting feed into the system and products out are problems external to the actual distillation.

A similar system is shown in Fig. 2 where a fluid-cooled external condenser is added to totally condense G_2. The still analysis will remain the same. If the ratio of Q_1/L_2 remains fixed, however, but L_1 varies, then the ratio of heat removed in the condenser to the quantity of distillate, Q_2/L_2, must also remain fixed by proper instrumentation.

The additional variables added by the total condenser are: 2 $(C+1)$ intensive variables (for L_2 and G_2) + 2 quantity ratios + 1 heat ratio — 1 quantity ratio fixed at unity — C material balances — 1 enthalpy balance $= C + 3$.

For two components in G_2 the condenser variables will be 5 and may be taken care of in the following manner: If the vaporizer is fixed (as in Fig. 1) then $C + 1$ variables are fixed in the stream $G_2 = 3$, the condenser pressure may be fixed the same as still pressure $= 1$, condition of condensate by controlling cooling fluid temperature $= 1$, totaling 5.

Condenser pressure may be controlled by the same methods as before, by putting the pressure control device or open vent between the condenser and the atmosphere.

Temperature control of L_2 may be obtained by inserting the thermal element of the instrument in the condensate overflow. For equilibrium to be obtained in the condenser, it is also necessary to bubble the

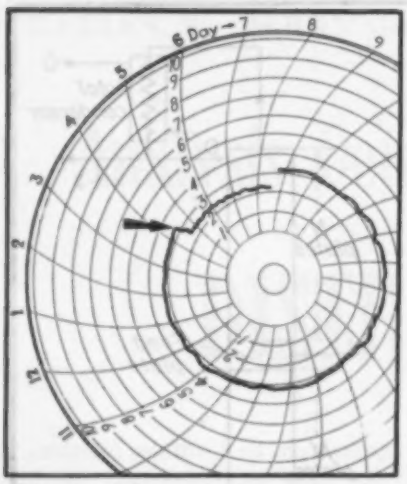


Fig. 4—Effect on column pressure of variation in rate of feed

incoming vapor through a pool of saturated condensate at the bottom of vertical tubes. If this is not done, a new variable, condenser efficiency, is introduced but can be assumed a fixed distance from equilibrium for steady condenser operation.

RECTIFYING COLUMNS

Consider the system described in Fig. 3, where a column with m plates below the feed, n plates above the feed, a single phase feed stream entering a central feed plate, a total equilibrium condenser and an equilibrium reboiler or vaporizer at the bottom is shown. In this case, specification of $m + n + 1$ plate efficiencies or percentage of approach to equilibrium will eliminate this number of independent variables. The number of variables in this case will then be $(m + n)$ $(3C + 2) + 5(m + n)$ intensive variables, quantity ratios and heat ratios for the plates except feed, $3(C + 1) + C + 5$ variables for the feed plate + $(2C + 5)$ for the reboiler + $(2C + 6)$ for the condenser + 2 variables for the number of plates above and below the feed. Relating these are $(m + n + 3)C$ independent material balances, $m + n + 3$ enthalpy balances and $2(m + n + 2)$ $(C + 2)$ equations of condition, composition and quantity ratios. The variance or degrees of freedom, found by subtracting the number of equations from the total number of variables is $C + 2m + 2n + 10$.

In common practice, the variables usually controlled are composition and condition of feed, heat losses from each section (may be zero), heat removed from the condenser, pressure over each plate, condenser, reboiler and the reflux ratio. Temperature, however, can be substituted for pressure throughout.

For the case of a single phase two component feed, the variance is $12 + 2m + 2n$.

It is assumed that m and n are fixed previously and are adequate in number to produce the required products without excessive reflux ratios and resulting high vapor velocities. It is also assumed that the condenser is large enough to condense the maximum amount of vapor.

The variance may be controlled as follows: Fix composition of feed = 1, fix condition of feed = 2, fix operating pressure throughout = $m + n + 3$, fix heat gain or loss from each plate and condenser = $m + n + 2$, fix heat supply to reboiler = 1, fix m and n (number of plates) = 2, fix reflux ratio = 1, which totals $2m + 2n + 12$.

Composition and condition of feed can be controlled in the same manner as in preceding examples.

Heat gain or loss from each plate can usually be assumed as zero for a well insulated column. For a fixed feed rate, heat supply to the reboiler may be fixed by a flow controller in the supply line. If the rate of feed is not fixed, a ratio flow controller proportioning the amount of steam to the rate of feed may be applied, since composition and condition of feed are fixed. This fixes the ratio of Q/L_s. It is assumed that the rate of change for either a supply or demand of matter of energy is not too great so that the column can become stabilized before another change takes place. For precision operation feed composition, condition, and rate should be kept fixed. It is then possible to fix all other variables at a definite position or rate of flow.

Fig. 4 shows the effect on column pressure of changing the rate of a subcooled feed to a column fractionating ethanol and water (at 4:30 a.m. on chart). The column was fed on the 20th plate of a 60-plate column. The pressure chart was taken from a pressure-sensitive element in the vapor space between the 25th and 26th plates from the bottom. Variation of a subcooled feed rate usually results in upsetting column performance and should be avoided.

If the feed rate varies it will be necessary to provide proprotioning control for the reflux. A simple device for accomplishing this is a box with double rectangular weirs of proper size. Fig. 5 shows the results obtained from a ratio flow controller blending two components prior to a simple evaporation. The closeness of control as indicated by the two orifice pens following each other is sufficiently accurate for most distillation problems.

Operating pressure can be substantially fixed as in the preceding section. This will substantially fix the pressure over each plate and in the still, unless wide variations in vapor velocity occur.

EFFECT OF PRESSURE DROP

The main object of automatic control in fractionation is to obtain uniform composition of products regardless of variations in operation. Variations in pressure drop across plates for atmospheric or higher pressure columns, with varying vapor velocity may not be important. For vacuum operation special means may be necessary to fix the pressure drop or keep it proportioned to temperature.

Variations in pressure with vapor velocity may be calculated by an equation proposed by Schneider (Thesis in Chem. Eng. M.I.T., 1938) provided an estimate of the maximum and minimum quantities of vapor and the plate detail dimensions are known. This pressure drop consists of two parts for conventional design—that due to the construction in the vapor pipe, and that due to slot friction. The liquid head on each plate is assumed constant in spite of slightly varying heights, due to variation in oxerflow. The pressure drop will be:

$$\Delta P = [m + n + 1]\,[0.0118\,S^2/d^4 + K(S/D)^{0.4}]$$

where ΔP is in inches of water, $m + n + 1$ is the total number of plates in the column, S is the cubic feet of vapor per minute per bubble cap, d is the diameter of the vapor pipe in inches, D is the total slot width per cap in inches, and K is a constant depending on cap design. Use of this equation in this way assumes a feed at its boiling point so that no increase or decrease in vapor quantity above the feed occurs, and also assumes nearly equal molal latent heats for the components.

PRODUCT COMPOSITION

If bubble plates are used, a method of maintaining fixed composition of bottoms is to vary the temperature proportional to pressure by having a pressure recorder reset a temperature controller. For practically pure products the approximate Clapeyron equation can be written as:

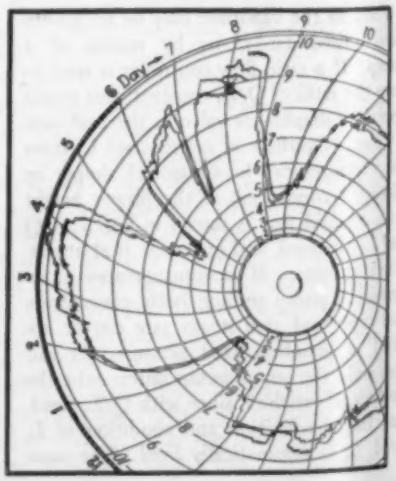
$$(P_2 - P_1 = e^{H/R\,(1/T_1 - 1/T_2)}$$

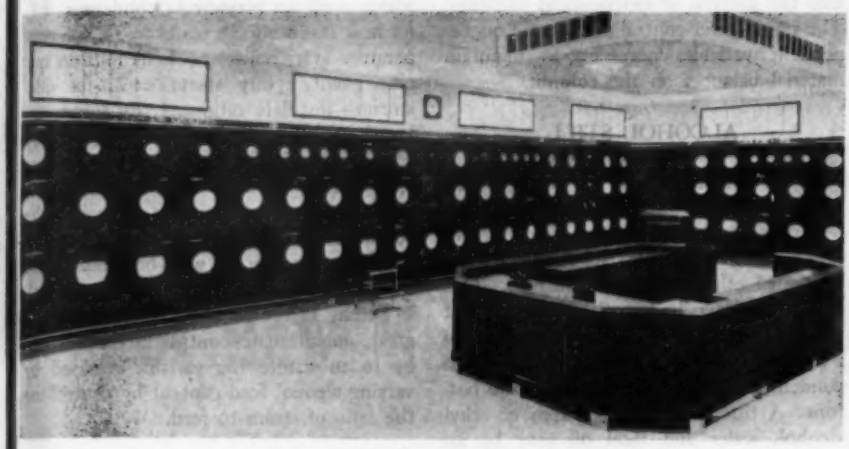
where P is pressure, T is temperature, H the molal latent heat, and R is the gas constant. H/R can be assumed constant. It is necessary, then, to work out a mechanical or electrical interlock between the two instruments so that a given ΔP produces a numerically equal change in

$$e^{K\,(1/T_1 - 1/T_2)}$$

For columns rectifying to substantially

Fig. 5—Chart showing operation of a ratio flow controller blending two components





Instrument panel of a large refinery

pure top and bottom products, several plates near the reboiler will often have nearly the same temperature, so that it is good practice to place the temperature-sensitive bulb of a controller in a section where a small change in composition would give a large change in temperature. A good indication as to favorable plates for locating temperature-sensitive elements may be had by plotting either tray temperatures or compositions (from design or actual data) as abscissae against the plates numbered from the bottom of the tower as ordinates. Such a plot without significant "bulges" would indicate difficulty in using temperature as a controlled variable. The elements should be placed in the regions of large bulges.

Further analysis is required for the system in Fig. 3 where feed composition is varied. For the case of a two component system, this will release an independent variable which may be taken up by controlling the bottom plate temperature and fixing the ratio of feed quantity to steam quantity. If more than one component is varied in a multi-component feed, the degree of freedom released may be taken up by specifying an additional component percentage in the product streams, controlled by specific gravity, color, etc. It is usually desired to keep product composition completely specified.

Similarly if a three-component feed is used, it is possible to specify only one concentration in the feed and allow the other degree of freedom to be taken up by fixing the ratio of the product streams providing process lags are favorable. This can be done by using the bottom product as a reference stream and returning as additional reflux excess distillate not necessary to maintain L_1/L_2 constant.

Now it may be desired to withdraw one sidestream continuously from the column of Fig. 3. For each sidecut the new variables introduced are $C + 1$ independent variables, one quantity ratio, plus one variable associated with the sidecut location. Additional equations are $C + 1$ equating the composition and condition of the sidecut to the composition and condition of the corresponding streams in the column. The net gain then is two variables.

Composition and heat condition of the sidestream will be exactly the same as the plate liquid from which it is withdrawn. The simplest way to control a sidestream is to fix the quantity and its location relative to another stream such as the feed. If all other variables are controlled the column will be completely fixed.

A situation may arise where it is desired to vary the quantity of sidestream. This case would occur when the composition of a three component feed was varied. If terminal conditions were maintained to produce practically pure distillate and bottoms, it would be necessary to vary the sidestream quantity to completely withdraw the intermediate boiling compound as a sidestream in a mixture with one or both of the others. In this case, it is desirable to leave adjacent plate temperatures uncontrolled and fix the sidecut plate temperature by a temperature controller.

PRACTICAL EXAMPLES

The type of analysis outlined above is useful in distillation of pure chemicals or mixed petroleum fractions. In the case of the latter, the products may in some cases be regarded as components in the Gibbs phase rule only if the many molecular species making up a component or product stream exhibit the same relative volatility when its concentration changes.

In the case of temperature control for petroleum fractions at tower terminals, usually a boiling range for a product will be encountered rather than a boiling point. The object here is to maintain the average.

For top tower temperature control a common method is to vary the reflux rate by means of an instrument operated from a temperature-sensitive element in the vapor line from the top plate to the condenser, or from some lower plate. This instrument operates a diaphragm valve in the discharge line of a reflux pump, or the steam to it. In all towers, capacity and transfer lags are found, consequently, changes in reflux rate must correspond to the rate at which operating equilibrium is attained. Otherwise cycling of the temperature will result. Material storage capacity in a tower acts unfavorably, since it increases transfer lag, and is a function of the number of plates.

It is common practice to deliberately leave one or more independent variables in a distillation system uncontrolled for convenience of operation. An example of this may be frequently found in the operation of gasoline stabilizer columns.

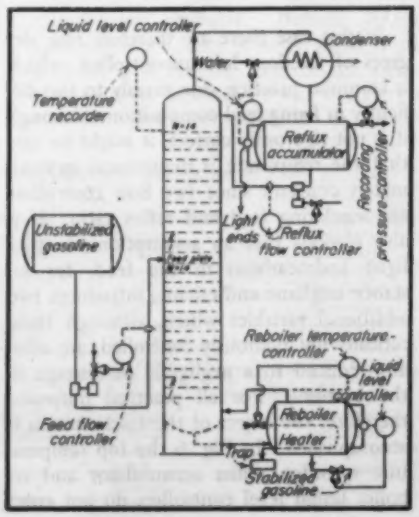
The purpose of a stabilizer column is to adjust the vapor pressure or boiling range of gasoline, as tower bottoms, by distilling off lighter components as overhead product, often consisting of propane and butane. The volume and composition of overhead product varies from time to time, so that top tower conditions are allowed to vary by not controlling temperature (Fig. 6).

STABILIZER CONTROL

A typical control method would be to fix tower pressure throughout by bleeding light fractions, or non-condensibles to the refinery gas system from a reflux accumulator through a diaphragm valve, operated by a pressure controller. Reflux rate may be fixed by a flow controller operating a reflux pump. Overflow from the reflux accumulator is controlled by a liquid level instrument which operates the amount of cooling water to the condenser. Rate of feed to the column is fixed by a flow controller operating a feed pump.

The most important variable, reboiler temperature, is controlled from a temperature-sensitive element in the vapor space of the reboiler, which varies the amount of steam admitted to the heating coil. In order to remove stabilized gasoline from the reboiler another liquid level controller is used, operating a diaphragm valve. This column operation follows the analysis of the system

Fig. 6—Stabilizer column control



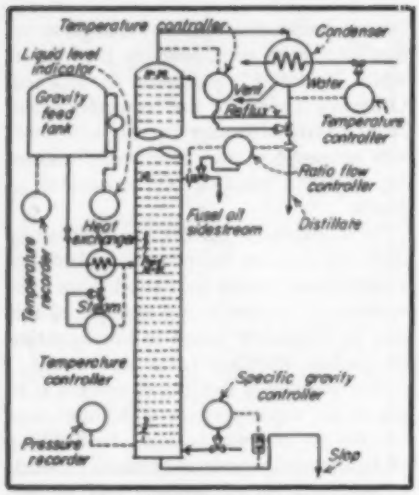


Fig. 7—Alcohol column control

shown in Fig. 3 in which feed composition is not fixed, and therefore, top tower conditions are allowed to vary. Only one product composition, the tower bottoms is specified.

The analysis would be as follows for a column having 29 plates, including the feed with a conventional condenser and reboiler. For simplification the feed may be considered to consist of three components, propane, butane and gasoline. The basic equation is $V = C + 2m + 2n + 10$ and substituting actual values this would be $V = 3 + 28 + 28 + 10 = 69$. These variables may be fixed or proportioned as follows: Fix pressure on 29 plates + reboiler + condenser = 31, fix condition of feed = 2, fix reboiler temperature = 1, fix number of plates above feed = 1, fix heat loss from each plate (zero) = 29, fix heat loss from condenser = 1, which totals 65.

It should be pointed out again that the individual condition on each of the plates, while enumerated as individual variables, may be grouped into one variable since fixing the pressure drop across the column actually fixes the pressure on each plate of the column.

VARIABLES UNCONTROLLED

In this case there are therefore four degrees of freedom left uncontrolled, which is common practice, due mainly to the difficulty in fixing feed composition. Although it is not rigorously correct, it might be said that the reflux rate is maintained approximately constant since two flow controllers are regulating feed and reflux ratio. It is also obvious that an assumption of other light hydrocarbons in the feed, for instance methane and ethane, introduces two additional variables which, although theoretically not rigorously controlled, are actually reduced to a negligible percentage in the bottoms. For all practical purposes, therefore, the object of the fractionation is accomplished. In Fig. 6 the top temperature recorder, reflux accumulator and reboiler liquid level controllers do not enter into the analysis of independent variables. The liquid level controllers operate on dependent variables necessary to maintain material balances on the column.

ALCOHOL STILL

An analysis follows for the case of a conventional fractionating system producing 190 proof industrial alcohol from fermentation mashes having about 8 percent (volume) ethyl alcohol in the feed. This system is shown in Fig. 7, and consists of a fractionating column with 58 actual plates of fixed efficiency, and a conventional condenser. Open steam enters at the bottom. A three-component system of ethyl alcohol, water and fusel oil may be assumed. The grain or molasses solids may be disregarded in this analysis, since their vapor pressure is substantially zero. The plates, however, are designed to accommodate the flow of these solids below the feed, however.

Fusel oil will accumulate in the central part of the column and is drawn off as a sidestream from the tenth plate above the feed. This will add two independent variables, as pointed out previously. The general equation will then become $V = C + 2m + 2n + 12$ which for the system would be $V = 3 + 2(21) + 2(36) + 12 = 129$. These variables may be fixed or proportioned as follows: Fix pressure above 58 plates = 58, fix pressure in condenser = 1, fix heat loss from 58 plates = 58, fix temperature (vary reflux) = 1, fix bottom specific gravity (vary steam) = 2, fix sidestream—distillate ratio = 1, fix sidestream location = 1, fix $m = 1$, fix $n = 1$, fix feed condition = 2, fix distillate temperature (by condenser water) = 1, totalling 129.

With the above variables controlled the column is fixed in operation. In actual distilling practice it will be difficult to exactly fix the percent alcohol from batch to batch. In the event that the variation is great, an alternate control method would be to substitute the variable released by varying alcohol feed content by controlling the ratio of steam to feed.

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GERMAN CHLORINE

(Continued from page 106)

(similar to, but somewhat larger than, the illustrated Wacker Billiter cell) containing 107 sq. ft. of diaphragm. External dimensions are roughly 18 ft. long, 10 ft. wide, and 2 ft. high. The body is steel, bare in the cathode (bottom) section but brick-lined above the cathode. Eight sandstone tops about 4½ ft. square and 2½ in. thick carry the graphite anode leads, which are 18 in. long and 4 in. in diam., cut down to 2½ in. diam. for the connections. There are 112 anodes, each 2½x3x24 in. in size. Apparently the anode current density is about 1.2 amp. per sq.in. The new anodes are slotted with four saw cuts to a depth of 1 to 1½ in. and are placed 0.4 in. above a new diaphragm surface. The sandstone tops are luted with putty and the anode leads are sealed with "cerisin." Anode life is about nine months, whereas, a diaphragm's life is six months. The cell, therefore, is dismantled for diaphragm renewal at six months; three months later the anodes are renewed, and the diaphragm is cleaned. After three months with the new anodes, the diaphragm is renewed, and the assembly operates for six months to complete the cycle.

The cathode chamber has rods on edge which support the cathode about 4 in. above the bottom. The closely woven cathode screen rests on the rods and supports the diaphragm, which is composed of four parts long-fiber asbestos and one hundred parts finely ground $BaSO_4$. These are mixed intimately. Blue fiber asbestos from Canada or South Africa is preferred. Glass cloth, as well as single and multiple asbestos papers have been tried, but the former were found to be soluble and the latter, too weak.

Brine level is indicated by a float. The inventory of brine in the cell is very large and hand regulation is satisfactory. Hydrogen lines are insulated at the point where they leave the cells, and corrugated effluent devices are used to prevent leakage of current through the cell effluent.

Bridge cranes of about one-ton capacity span all cells for handling the sandstone slabs; the cell body is seldom moved and probably has a life of ten years. Labor requirements were given as 20 men per day to operate and maintain 160 Billiter cells. This is equivalent to 1.6 man-hr. per 1,000 lb. of chlorine. The floor space for cells only is about 600 sq.ft. per 1,000 lb. of chlorine per day.

The Billiter cells operated by Wacker at Burghausen (see illustration) are rated at 6,000 amp. and are smaller than those described at Bitterfeld. The fundamental data, such as current density, graphite life and operational life, are approximately the same in both plants.

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PROCUREMENT

Of Raw Materials for High Explosives

Because in the war this country used TNT more extensively than any other high explosive, the principal problems encountered in the munitions program consisted in establishing ample supplies of ammonia, oleum, and toluene. Requirements for nitration grade toluene forced expansion of plant capacities to about 20 million gallons a month. To supply oleum needs, The War Department built 9 contact acid plants with monthly capacity of 70 thousand tons on 100 percent basis. A daily capacity of 1,940 tons of ammonia was installed at Ordnance works.—*Editors*

DECEMBER 7, 1941 found in this country an immeasurably better equipped and established chemical industry to process basically naturally occurring materials into raw materials for war than was the case in 1917. Processes had been developed, and in plant scale operation, to covert the natural materials into finished explosives. The problems facing the chemical and related industries and the armed services at the start of this war in so far as raw materials for standard explosives were concerned, therefore, dealt mainly with procurement from existing sources and expansion of existing operations.

In those cases where procurement could be accomplished from existing sources, the government relied on prime contractors who operated explosive plants. Government as opposed to its prime contractors has procured or sponsored production of raw materials for explosives only where an extraordinary condition, such as a national shortage, has dictated such a course. Shortages due mainly to explosive production have been experienced particularly in the case of sellite, phenol, diphenylamine, dimethylaniline, toluene, methanol, oleum, and ammonia and its derivatives. Production capacity for these raw materials accordingly has been established either in government-sponsored privately-owned plants or government-owned plants.

Because of their relative importance, this discussion is confined to toluene, ammonia and oleum programs since the problems outlined for these materials and procedures employed to meet requirements, may be considered typical for all other explosive raw materials for which new ordnance-sponsored capacity was necessary.

TOLUENE

This country, in this war, has used TNT as a bursting charge for bombs and shells to a greater extent than any other high explosive and toluene therefore has been greatly in demand. It has been roughly estimated that a pound of high explosive is required per service man per day. This rule of thumb is sufficiently reliable for our purposes and can be used as the basis for calculation in lieu of official figures which cannot be revealed. If we use the base figure of a 10,000,000-man army, our rule of thumb requires TNT production capacity to the extent of about 300,000,000 lb. per month, assuming no other high explosives were used. Inasmuch as about 0.5 lb. of toluene is required per lb. of TNT, supporting toluene capacity to the extent of approximately 21,000,000 gal. per month is required.

Prior to the start of the war, it was clearly seen that the byproduct industry in this country which could be counted on to supply approximately 2,500,000 to 3,000,000 gal. of nitration grade toluene per month, could not support an explosives program of the magnitude required and steps were taken by the petroleum industry and the Ordnance Department to establish plants for the recovery or synthesis of toluene from petroleum. By the use of processes largely developed by the petroleum industry prior to Pearl Harbor, sufficient toluene has been thus obtained.

The accompanying table lists significant facts regarding the 15 petroleum toluene plants in this country. Total capacity of these plants is almost six times that of the byproduct industry and normally is estimated at about 17,000,000 gal. per month of nitration grade toluene. It will be noted that most of the petroleum toluene capacity is concentrated in coastal areas on the gulf coast, east coast and west coast. At the time the basic plans for the establishment of these plants were being made, the possibility of shelling by enemy ships and bombing by enemy planes had to be considered and coastal areas were consequently not desirable. Because toluene production amounts to only about 1 percent on a volumetric basis of the output of a refinery, however, it was necessary to establish plants as adjuncts to existing

Petroleum Toluene Plants in United States in 1945

Operator	Plant Location	Ownership	Type of Operation
Continental Oil Co.	Ponca City, Okla.	Private	Synthetic
Continental Oil Co.	Ponca City, Okla.	DPC	Recovery
Gulf Oil Co.	Philadelphia, Pa.	Private	Recovery
Humble Oil & Refining Co.	Baytown, Tex.	War Department	Synthetic
Magnolia Petroleum Co.	Beaumont, Tex.	DPC	Recovery
Pan American Oil & Refining Co.	Texas City, Tex.	Private	Synthetic
Pure Oil Co.	Toledo, Ohio	Private	Synthetic
Shell Oil Co.	Houston, Tex.	Private	Recovery
Shell Oil Co.	Wilmington, Calif.	Private	Synthetic
Shell Oil Co.	Wood River, Ill.	Private	Synthetic
Sinclair Refining Co.	Marcus Hook, Pa.	Private	Recovery
Standard Oil Co. of Calif.	Richmond, Calif.	Private	Synthetic
Standard Oil Co. of Ind.	Whiting, Ind.	Private	Synthetic
Standard Oil Co. of La.	Baton Rouge, La.	DPC	Recovery
The Texas Co.	Lockport, Ill.	Private	Synthetic
Union Oil Co. of Calif.	Oleum, Calif.	Private	Synthetic

refineries otherwise a toluene program of the size required could not have been established without the utilization of refinery capacity in coastal areas.

Use of private funds for the construction of toluene plants wherever possible had a number of advantages, principal among which were:

Privately-financed toluene facilities were capable of being better integrated with existing refinery facilities than a government-owned plant which required government-owned property normally adjacent to, rather than in the mother refinery. Duplication of roads, utilities, sewers, hospitals, laboratories, etc., was thereby largely avoided.

Use of private funds served as a strong incentive to maintain construction costs and the use of equipment vitally needed in other war expansion at a minimum.

Construction by private forces using private funds largely eliminated government overhead and administrative expense during the construction period.

The use of private funds for the construction of toluene plants is expected to result in huge monetary savings to the government.

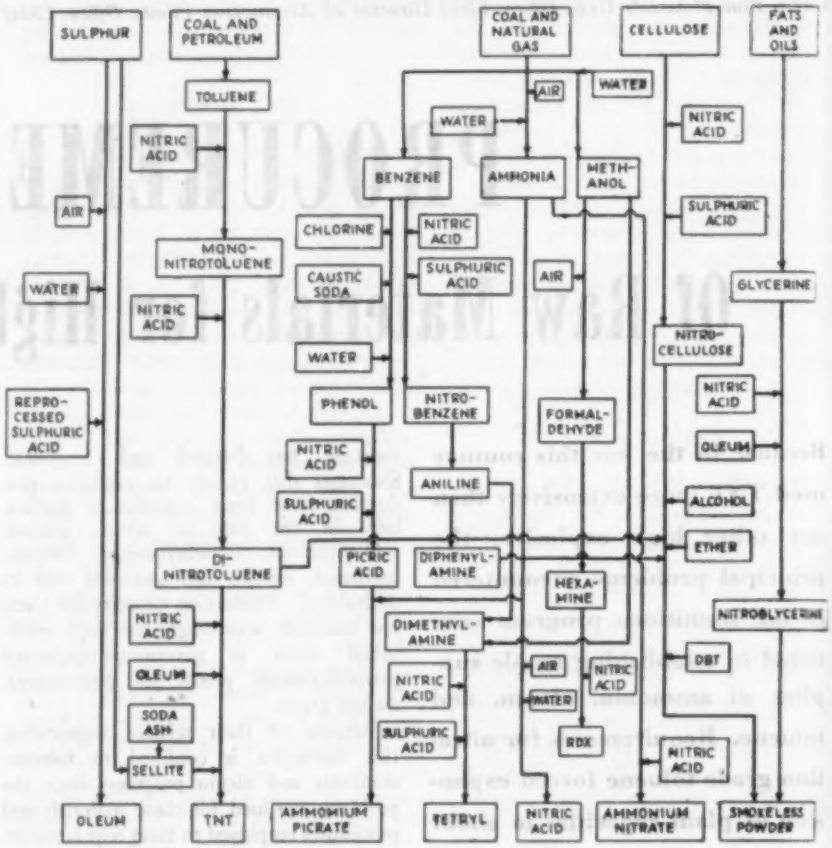
PROCESSES

Processes in use for the production of toluene from petroleum are of two general types. First is the recovery process which type isolates the naturally occurring toluene and petroleum crudes by fractional distillation followed by azeotropic or extractive distillation. Purification is normally achieved by acid-treating and re-running. It is worthy of note that simple fractional distillation alone for isolation of toluene is not commercially feasible because of the presence of non-aromatic constituents of crude oil which boil very close to toluene. Such hydrocarbons must be separated from toluene by azeotropic or extractive distillation. Inasmuch as the toluene content of U. S. crude oils is generally in the neighborhood of 1 percent, toluene recovery operations require considerable fractionating capacity.

The synthetic processes dehydrogenate naphthenes such as methylcyclohexane in the presence of suitable catalysts to form the corresponding aromatics. Hydroforming, one of the two principal synthetic processes being used, is described in a recent article (*Chem & Met.*, August 1944). Synthetic operations are normally followed by recovery and purification steps of the type mentioned above.

Toluene is an excellent aviation gasoline blending agent in that it has a rich mixture blending value better than 100; it does not have a high freezing point such as its homologue benzene and has a lower boiling point than its homologue xylene. Although the plants listed were all originally sponsored for the production of toluene

EXPLOSIVES FLOW DIAGRAM



intended for explosives, Ordnance has not always required their full output and surpluses over and above quantities required for ordnance have been used in the production of aviation gasoline. In particular cases certain facilities were able to contribute more to aviation gasoline by operation in an entirely different manner than originally intended, and toluene operations have at times been interrupted or terminated in favor of other production.

OLEUM

Although fuming sulphuric acid does not contribute to the final chemical structure of any of the explosives used in the late war, it is required in our present processes because of its dehydrating properties and it is more important tonnagewise than any other material or end product in the field of explosives. It finds its most important use in the production of TNT for approximately 2 lb. of 40 percent oleum (100 percent H_2SO_4 basis) is required per lb. of TNT produced. Only about 5 percent of the oleum used, however, is actually consumed in the TNT process and problems surrounding the supply of oleum to TNT works are enormously complicated by the necessity for finding a home for about 2 lb. of spent sulphuric acid (100 percent basis) per lb. of TNT. Because of pollution problems, spent acid cannot be run into streams and rivers and a total of about 4 lb. of sulphuric acid (considering both incoming oleum and outgoing spent acid) must therefore be transported to and from a TNT works for every pound of TNT produced.

On the basis of the rule of thumb method which would indicate the necessity for TNT capacity to the extent of about 300,000,000 lb. per month, it is apparent that a supporting oleum capacity of about 300,000 tons per month will be required. In 1939 this country is reported to have had only 70 contact sulphuric acid plants with a total virgin acid capacity of about 180,000 tons per month (100 percent basis). Forty percent oleum capacity was almost negligible. In making plans to establish oleum capacity of the magnitude required, chemical industry and the War Department were faced with a twofold problem; construction of substantial new acid and oleum capacity and development of means for disposition of the spent acid. As in the case of the war program and with so many other items, the job could not have been done in the time required without the active support and counsel of industry.

Where feasible, the required oleum power and auxiliary equipment were erected in privately owned prewar contact acid plants so as to take full advantage of existing sulphuric acid capacity. But it was also necessary to establish considerable additional acid capacity both government-

owned and privately-owned along with corresponding oleum capacity. The War Department consequently has built 9 contact acid plants with a total virgin acid capacity of about 70,000 tons per month (100 percent basis) at explosive works.

In view of the large tonnage of sulphuric acid which must be transported per pound of TNT produced, it would at first glance appear desirable to include an oleum plant in each TNT plant. The desirability of constructing a government-owned oleum plant on a TNT plant must, however, always be weighed against the cost of bringing the oleum in from outside the plant and spent acid disposition problems. At present only about half our TNT plants include oleum plants.

SPENT ACID

Important considerations which must be fully explored and evaluated prior to construction of an oleum plant and a TNT plant are: Establishment of a government-owned oleum plant and a TNT plant throws spent acid into commercial markets in the area. Such spent acids supplement the supply of virgin acid available from private facilities in the area and unless suitable precautions are taken, serious problems of disposition of the spent acid may arise which could become so acute as to necessitate curtailment or shutdown of private virgin acid operations in order to make room for TNT spent acids. It has never been necessary to shut down any private acid plant in order to move spent acid but indiscriminate establishment of government sulphuric acid plants could easily flood acid markets in particular areas. Well planned disposition of TNT spent acid is just as important as the supply of oleum itself and before oleum is moved into any TNT plant, markets for the resulting spent acid are definitely earmarked.

Where sufficient oleum capacity from private sources can be made available from localities very close to the TNT plant, a government oleum plant is usually unnecessary. The large TNT plant at Weldon Springs, Mo., just outside of St. Louis, for example, does not include a government-owned oleum plant because of the substantial private contact acid capacity in the St. Louis area.

If the oleum supply is drawn from outside a TNT works, four times as much acid (100 percent basis) as TNT must be transported and tank car supply becomes a matter of primary consideration. For a TNT plant which produces 20,000,000 lb. of TNT per month, for example, about 80,000,000 lb. of sulphuric acid (100 percent basis) must be moved each month. If we assume that each acid tank car carries 50 tons of acid per trip, and that each car makes four round trips per month a fleet of approximately 200 acid cars is required to handle the acid for this plant alone. Due to the general well publicized shortage of tank cars during the war, considerable effort has been devoted to expediting the loading, movement and return of acid cars. It is interesting to note that during the hectic days immediately following Pearl Harbor, oleum supply in certain areas had not yet been brought to the levels required to support TNT operations in the same area. An extraordinarily long oleum movement was sometimes required to keep TNT operations going. Freight costs often were more than the value of the oleum f.o.b. producing points. In December 1941, for example, it was necessary to ship oleum from the Baton Rouge, La., area to the Plum Brook Ordnance Works at Sandusky, Ohio. Movements of this type put a severe load on acid car fleets and it was only through the help given the War Department by railroad men in clearing cars through congested metropolitan yards that explosive plants were kept in operation—although sometimes on only a few hours oleum stock.

The principal avenues employed for disposition of spent acid are: Up to about 39 percent of the oleum (100 percent basis) usually is returned to the oleum plant for fortification; such returned acid is normally concentrated to 66 deg. Be. at the explosive works prior to shipment. Theoretical considerations prevent the use of any larger percentage for fortification.

Wherever economic considerations permit, TNT spent acid is used in the manufacture of other explosives which do not require oleum such as smokeless powder and ammonium picrate. Efficient utilization of TNT spent acid for other explosives operations is highly desirable in that it precludes the necessity of new virgin acid capacity to support such explosives operations and it automatically eliminates competition for markets between virgin acids and privately owned plants and government spent acid. A number of explosive plants which manufacture both TNT and smokeless powder are in operation, thereby permitting consumption of much of the TNT spent acid in the plant.

AMMONIA

If any one material can be considered the cornerstone of the explosives industry, ammonia must be given that honor. We could, if all toluene capacity were suddenly obliterated, use various substitutes such as phenol or aliphatic materials for the production of high order explosives; if all oleum capacity were suddenly lost, we could use various expedients to limp along without that acid; but practically all explosives depend for their action on the presence of nitrogen in their structure. Ammonia is the door through which nitrogen of the air passes on its way to serve as a constituent of explosives.

Pressure oxidation of ammonia over platinum-rhodium gauze to form nitric acid is a preliminary step in the production of each of these high explosives and ranks as the primary use of ammonia in explosives operations. During the early stages of this war when TNT was at times in short supply, ammonia also was used to make explosive grade ammonia nitrate which supplemented and extended available supplies of TNT.

Ammonia is almost unique among the raw materials required for explosives in that prewar capacity in this country was of the order of magnitude required for a munitions program. This was particularly fortunate because the complexity of ammonia plants, the high pressure piping and forgings and compressors required in their construction, mean longer periods between drawing boards and initial operation than for most other types of munitions plants. Prewar capacity for ammonia in this country is reported to have been about 1,500 tons of ammonia per day. During the months immediately preceding and following the fall of France, when every pound of explosives was needed, almost one-half of this country's industrial ammonia capacity was diverted from commercial customers to munitions work and ammonia consequently has never been the limiting factor in explosives production.

It will be noted that the ammonia capacity for munitions production exceeds that reported as the prewar industrial capacity, but the total of both our private and government ammonia capacity is still less than the reported German synthetic ammonia capacity of about 115,000 tons per month for the year 1937. The Leuna Works at Merseburg alone are believed before conversion to gasoline production, to have been capable of producing about 2,000 tons of ammonia per day—as much as the entire ordnance ammonia capacity of this country.

War Department-Sponsored Ammonia Plants *

Plant	Location	Process Raw Material	Approx. Daily Capacity†	Operator
Morgantown Ordnance Works	Morgantown, W. Va.	Coke	170	DuPont
Buckeye Ordnance Works	Ironton, Ohio	Coke	400	Atmospheric Nitrogen
Ohio River Ordnance Works	Henderson, Ky	Coke	200	Atmospheric Nitrogen
Dixie Ordnance Works	Monroe, La.	Natural gas.	185	Commercial Solvents
Ozark Ordnance Works	El Dorado, Ark	Natural gas.	400	Lion Chemical
Jayhawk Ordnance Works	Pittsburg, Kan.	Natural gas.	400	Military Chemical
Missouri Ordnance Works	Louisiana, Mo.	Natural gas.	185	Hercules Powder
Cactus Ordnance Works	Etter, Tex.	Natural gas.	200	Shell Chemical
		Total	2,140	

* TVA at Muscle Shoals, Ala., a DPC plant at Lake Charles, La., and an incomplete plant at Sylacauga, Okla., are not listed. † Short tons. Exclusive of ammonia capacity normally used for methanol production.

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ACETYLENE
Industry in Wartime Germany

Unfolding before the world is the story of a remarkable development of an acetylene industry. It was forced upon Germany by the lack of petroleum reserves and carbohydrate material. Some idea of the extent to which the industry has grown may be had from the accompanying statistics on acetylene production from calcium carbide and by the electric arc and also from data on a large variety of derivatives and synthetic products made from this important and plentiful raw material.—*Editors*

In a recent news release the extent of the acetylene industry in Germany as developed during the war was indicated. It is the purpose of this article to present statistics on acetylene production from calcium carbide, and by the electric arc, and also figures on a large variety of derivatives and synthetic products made from this very important raw material.

It will be understood that the production figures for all of the products obtained from acetylene by a series of reactions are somewhat difficult to correlate because of shifts of production from one plant to another in Germany due to bombing and for other reasons. However, it is believed the statistics are reasonably accurate for the year 1942 and early 1943 which were peak years in production. It is very interesting to note that facilities under construction and planned expansions greatly exceeded the maximum production obtained. As a matter of fact, it is not possible to present a clear-cut picture of the situation in 1944 when the bombing was most intense; for example, in that year the main production of calcium carbide and acetylene derivatives was shifted to three plants, operated by I. G., which escaped bomb damage. One of these was the synthetic rubber plant at Schkopau, located a few kilometers north of the Leuna Works at Merseburg. This plant was the second largest calcium carbide producer in Germany. Damage to the Knapsack plant in the Ruhr and need for more acetylene led to the construction of a large unit at Huels for producing acetylene by electric arc cracking of off gas from hydrogenation units and from natural gas wells in the immediate vicinity. Another plant, Anorgana Werke G.m.b.H., was government owned and located at Gendorf, a few kilometers from the Austrian border near Burghausen. The Gendorf Works was near several large calcium carbide producers and had large facilities for conversion of acetylene to ethylene glycol and other derivatives. It was to the latter plant that many of the Ludwigshafen operations and much of the personnel were shifted in 1944 when it became apparent that rebuilding could not keep pace with the persistent bombing.

The statistics collected and reported here were obtained from documents and personal investigation of important chemical plants and are believed to be reasonably accurate.

AMBITIOUS PROGRAM

Plants producing calcium carbide were scattered quite widely throughout Germany. Table I shows the distribution of capacity in 1940. Table II is a list of producers which showed but slight change in 1942. However, it will be noted a very ambitious expansion program was underway which would have meant approximately doubling the capacity. It is interesting that the I. G. Farbenindustrie and related groups accounted for approximately two-thirds of the capacity.

In general, the location of carbide plants was dictated by favorable situations regarding raw materials, and a cheap and ample source of power. It is noted that in the expanded program Ludwigshafen was to have a production capacity of 13,500 metric tons per year. The plant was an exception to the rule since neither cheap power nor a favorable raw material situation was obtained. The plant was operated because of the diversified manufacturing activities at this parent plant of I. G. and it was here that most of the advances were made in acetylene chemistry under the direction of Dr. Walter Reppe. Approximately 23 percent of the plants operated on hydroelectric power and the balance on current generated from brown coal deposits. Plants using hydroelectric power were at Burghausen, Hart, Waldshut, and Wylen with a combined capacity of 27,000 metric tons per year. With the planned expansion about the same percentage of plants operating on hydroelectric power was to be maintained.

CALCIUM CARBIDE PLANTS

Table III presents figures on the use of calcium carbide for various purposes, also given are figures on the planned increase in capacity. Comparison with Table II shows that the calcium carbide plants were operated at approximately 90 percent of their rated capacity. Of the total production aproximately 53 percent of the carbide was used in the chemical process industry and approximately the same ratio was to be maintained with the expanded program.

It is to be noted that very large amounts of acetylene went into the manufacture of butadiene. The major portion was made by the four-step process through acetaldehyde and aldol. Another very interesting war development was a plant operated at Ludwigshafen on the process worked out by Dr. Reppe that consisted in reacting formaldehyde with acetylene to form 1.4-butynediol which was hydrogenated to 1.4-butanediol. The latter product was then dehydrated in two steps to give in succession tetrahydrafurane and butadiene.

From Table III it is seen that approximately 710,000 metric tons per year of calcium carbide, corresponding to 238,000 metric tons of acetylene, was used for the manufacture of chemicals, synthetic rubber and other products. This was supplemented by approximately 70,000 metric

tons of acetylene made by the electric arc at Hüls. The unit was built as a wartime measure and had combined with it several new processes for converting acetylene to miscellaneous chemicals.

Table IV gives the statistics on the production of calcium carbide, acetylene, and solvents produced at the I. G. Farbenindustrie plants. This production in turn accounted for approximately 80 percent of the entire German chemical industry.

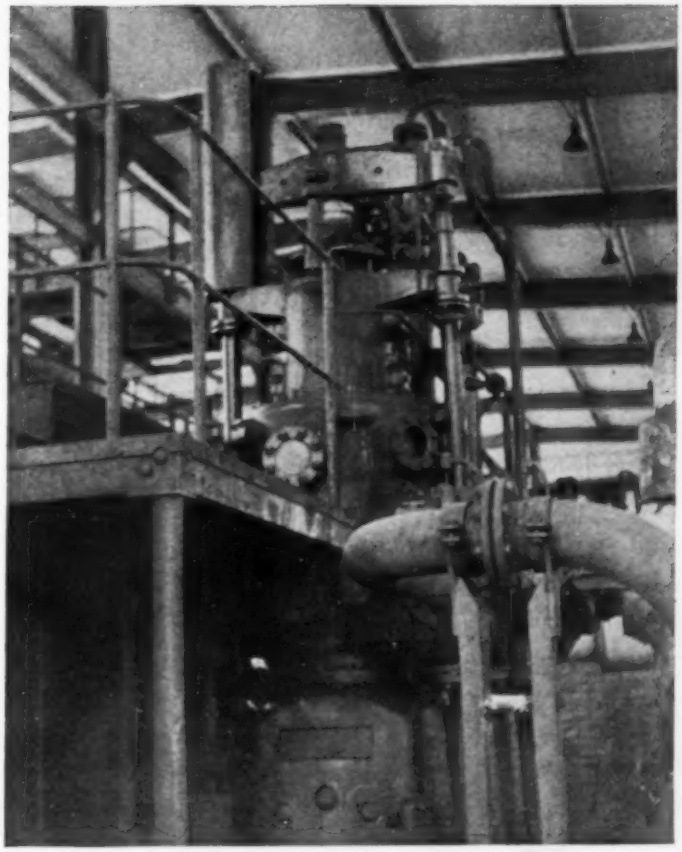
A very interesting development was the conversion of large quantities of acetylene to ethylene by catalytic hydrogenation. Table V shows the extent of this industry at the end of 1940 and at the start of 1942. It is to be noted that ethylene made by this method represented the major source employed in the manufacture of ethyl benzene for styrene. It was also the raw material for ethylene oxide and its derivatives and for polymerization products. It is noteworthy that capacity for ethylene production from acetylene was being increased considerably. As Table II indicates, the calcium carbide plant at Schkopau was being enlarged to 34,000 tons a year, the increase being divided between butadiene production and ethylene for styrene. Increased capacity for ethylene production from acetylene is also indicated in Table V at the Hüls Works. An increasing amount of ethylene was also being used for the manufacture of ethylene oxide and derivatives at several plants as is shown in Table V. However, toward the end of the war the production of these chemicals was shifted to Eastern Germany at Auschwitz and the large government plant previously mentioned at Gendorf.

A very important use of acetylene was in production of vinyl compounds for thermoplastics, adhesives, lacquers, and additive to lubricating oil. Table VI gives the statistics of these types of plastics for the year 1941, 1942, and 1943.

A development which was peculiar to Germany was the large scale production of vinyl ethers of methyl, ethyl, isobutyl, and higher alcohols. These new materials were developed from the research of Dr. Reppe at Ludwigshafen and found wide use as lacquers and adhesives as straight polymers and copolymers with other vinyl compounds. They were marketed under the trade name of Igevine.

The vinyl acetate polymers were called Mowiliths. Manufacture of these materials was carried out at the Höchst plant of I. G. Farbenindustrie and by Dr. Alexander Wacker, G.m.b.H. at Burghausen.

The Igelits plastics comprised perhaps the most important class of thermoplastics in wartime Germany. They consisted of polyvinyl chloride: the PCU types were unchlorinated while the PC types were chlorinated after polymerization. One of the large uses of unplasticized polyvinyl chloride was in piping and valves for the chemical process industry as a substitute for stainless steel. Piping up to 8-inch diameter was made by extrusion and larger sizes were fabricated by welding with a hot air torch. Other large uses were in molding compositions, screen, continuous filament, and staple fiber. Plasticized polyvinyl chloride was used extensively in manufacturing raincoats for the Wehrmacht, rubber gloves and similar products. Other important plastics were the Acronals or acrylic resins and various types of polystyrene. At the bottom of the table the production of Oppanol B is given. This material which was polyisobutylene was not made from acetylene but is included because it had similar uses to other plastics noted.



I.G. Gendorf two-stage chlorine compressor

MONOMERIC ACRYLONITRILE

Another plastic which is not included in Table V was the polyacrylonitrile. Production figures for this material are included under buna rubber. A new development was the synthesis of monomeric acrylonitrile from acetylene and HCN. Small plants were in operation at Ludwigshafen, Leverkusen, and Hüls. Other vinyl compounds which were produced on small scale were the derivatives of secondary heterocylic amines; for example, an experimental plant was in operation at Ludwigshafen on a Reppe development for the manufacture of vinyl carbazole. The polymer, called Luvican, had a very high melting point. A tripolymer which had a sufficiently high melting point to be resistant to boiling water could be molded by injection. Another N-vinyl compound was used as a low polymer in a water solution as a substitute for blood plasma. Other developments which were in the experimental stage were the synthesis of the acrylates and a starting material for a nylon type of product.

The largest projected increase in the use of acetylene was in the production of plastic materials. Although production statistics were not available in 1943 and 1944, Table VII shows the capacity, as of March, 1943, with construction in progress and planned expansion. It includes the polyamides and buna rubbers. With the completion of this program, calcium carbide capacity would have attained the figures shown in Tables II and III with a planned increase to a total of approximately 2,500,000 metric tons per year. The schedule called for a utilization of 54.5 percent in chemical processing and would correspond to an equivalent of 440,000 tons of acetylene. Adding the production by the electric arc at the Hüls Works makes a total planned acetylene consumption for chemical manufacture of 510,000 metric tons per year.

Thus we have unfolded before us the

Table I—Calcium Carbide Capacity In Germany 1940

Plant	Firm	Capacity in Metric Tons per Year
West Germany		
Knapsack	A.G. f. Stickstoffdunger	220,000
Steele (Idle)	Carbidwerk Wilh. Vogelsang	(6,000)
Hüls (Arc Acetylene)	Chem. Werke Hüls G.m.b.H. (In const'n. equiv. approx. 200,000 ton of carbide)	
		220,000
Central Germany		
Piesteritz	Bay. Stickstoff-Werke	200,000
Mückenburg	Dr. Alex. Wacker G.m.b.H.	21,000
Spremberg	Lonza G.m.b.H.	15,000
Hirschfelde	Elektro Chem. Ges.	10,000
Falkenau	Aussiger Verein	30,000
Schkopau	I. G.	220,000
		496,000
East Germany		
Bobrek	Schaffgotsch'sche Werke	26,000
Chorzow	Ver. Stickstoff Werke Moscice-Chorzow	150,000
Lazisk	Elektrowerke G.m.b.H.	36,000
		212,000
South Germany		
Hart	Bay. Stickstoff Werke	220,000
Schalchen (idle)	Bay. Stickstoff Werke	(20,000)
Burghausen	Dr. Alex. Wacker G.m.b.H.	58,000
Waldshut	Lonza G.m.b.H.	85,000
Wylen	Deut. Gold u. Silbersch.-anstalt	10,000
Freyung	Wiede's Carbid Werke G.m.b.H.	10,000
Landeck	Cont. Ges. f. angew. Elek	11,000
Deutsch-Matrei (idle)	Carbidwerk Deut. Mat. A.G.	(10,000)
		394,000
Total German capacity		1,322,000

Table II—Calcium Carbide Producers in Germany

Group	Works	Capacity May 1942 Met. Tons per Mo.	%	Planned Capacity Met. Tons per Mo.	%
I.G.	Knapsack	25,000		25,000	
	Schkopau	21,000		34,000	
	Ludwigshafen	.....		13,500	
	Auschwitz	.....		18,000	
		46,000	38	90,500	43
B. ST. W.	Piesteritz	17,000		17,000	
	Deggendorf	.....		9,000	
		17,000	13	26,000	12
Wacker	Burghausen	5,000		5,000	
	Mückenberg	8,500		8,500	
		13,500	11	13,500	6
Ch. Werke Aussig	Falkenau	2,500	2	4,000	2
I.G. and related Groups		79,000	64	134,000	63
VIAG	SKW-Hart	15,000		24,000	
	Königshütte	13,500		26,000	
		28,500	23	50,000	24
Lonza	Waldshut	6,000		11,000	
	Spremberg	2,000		2,000	
		8,000	7	13,000	6
Deguma	Wylen	1,000		1,000	
	Fürstenberg	.....		8,000	
		1,000	1	9,000	4
Schaffgotsch	Bobrek	3,000		3,000	
Heyden	Hirschfelde	1,000		1,000	
Elektrowerke	Oberlazisk	950		950	
Cont. Ges. El.	Landeck	600		600	
Wiede	Freyung	600		600	
All Works		6,150	5	6,150	3
Grand total per Mo.		122,650	100%	212,150	100%
Grand total per Yr.		1,471,800		2,545,800	

Table III—Consumption of Calcium Carbide in Germany

Use	Consumption Met. Tons per Mo.	%	Planned Capacity Met. Tons per Mo.	%
Calcium cyanamide	26,000	24	58,000	28
Buna rubber	23,000	21	42,000	20
Ethyl alcohol	.....	..	7,000	3
Vinyl compounds and chlor. hydrocarbons	6,000	5	12,500	6
Ethylene (excl. of buna and lub. oil)	5,000	4.5	18,000	9
Acetaldehyde (excl. of buna)	23,000	21	28,000	13
Miscellaneous chemicals, acrylonitrile, etc.	.....	..	4,500	2

Table III—Consumption of Calcium Carbide in Germany (Continued)

Use	Consumption Met. Tons per Mo.	%	Planned Capacity Met. Tons per Mo.	%
Lubricating oil	.....	..	4,500	2
Acetylene black	2,000	2	3,500	2
Domestic requirements	20,000	18	27,000	13
Other uses	5,000	4.5	5,000	4.5
Total per mo.	110,000	100%	210,000	100%
Total per yr.	1,320,000		2,520,000	

Table IV—Production of Solvents From Acetylene at I. G. Plants—January 1942

(Metric Tons Per Year)

	Knapsack	Schkopau	Hüls	Other I.G. Plants	Total
1. Raw materials					
Fresh lime	262,500	180,000	.....	.....	442,500
Sinter lime	31,500	160,000	.....	.....	191,500
*Coal	176,400	272,000	.....	.....	448,400
Coke oven gas, mil. m³	.....	.....	37	.....	37
Hydrocarbons	.....	.....	131,000	.....	131,000
Power, mil. Kw.-hr.	970	1,160	936	.....	3,066
2. Products (primary)					
Calcium carbide	294,000	352,000	.....	.....	646,000
Acetylene	.....	.....	70,000	.....	70,000
3. Carbide distribution					
Carbide to cyanamide	84,000	.....	.....	.....	84,000
Carbide (sold)	56,440	.....	.....	.....	56,440
Carbide to acetylene	153,000	352,560	.....	.....	505,560
4. Acetylene production					
From carbide	47,000	108,000	.....	8,530	163,530
By arc cracking	.....	.....	70,000	.....	70,000
Total	.....	.....	.....	.....	233,530
5. Products from acetylene					
Vinyl ethers	.....	.....	.....	2,400	2,400
Vinyl acetate	.....	.....	.....	10,200	10,200
Vinyl chloride	.....	15,000	.....	3,000	18,000
Chlor. hydrocarbons	.....	.....	.....	13,800	13,800
Acetaldehyde	72,000	142,800	110,300	.....	325,100
6. Products from acetaldehyde					
Butadiene	.....	48,600	33,700	.....	82,300
Ethanol (byproduct)	.....	20,500	6,640	.....	27,140
(Crotonadehyde)	.....	.....	.....	(26,200)	(26,200)
Butanol	.....	3,100	3,200	20,000	26,300
Butyraldehyde	.....	.....	1,000	1,300	2,300
Acetic acid	24,000	13,000	.....	25,000	62,000
Acetic esters and salts	.....	.....	.....	36,000	36,000
Acetic anhydride	13,800	.....	.....	7,700	21,500
Ethyl acetate	.....	.....	.....	14,000	14,000
Acetone	7,200	2,400	1,630	.....	11,230
Diethyl ether	.....	.....	.....	6,480	6,480

* Exclusive of coal for sinter lime.

Table V—Productive Capacity for Ethylene and Derivatives

	Capacity — Metric Tons per Year					
	Ludwig-shafen	Holten	Zweckel	Hüls	Schkopau	Total
1. Ethylene						
End 1940	7,200	5,760	5,760	5,400	10,400	34,520
Start 1942	7,200	7,700	7,700	34,400	16,700	75,700
2. Ethylbenzol						
End 1940	6,000	.....	.....	12,600	15,600	34,200
Start 1942	6,000	.....	.....	44,000	20,000	70,400
3. Styrene						
End 1940	4,200	.....	.....	9,720	12,000	25,920
Start 1942	4,200	.....	.....	21,600	16,200	42,000
4. Miscellaneous Products						
A. Kybol (1942)	.....	.....	.....	20,000	.....	20,000
B. Acetophenone (1942)	.....	.....	.....	6,900	.....	6,900
C. Ethylene dichloride						
End 1940	1,200	1,440	1,440	2,000	2,400	8,480
Start 1942	1,200	1,920	1,920	2,000	2,400	9,440
D. Ethylene oxide						
End 1940	6,000	7,200	7,200	10,000	12,000	42,400
Start 1943	6,000	9,600	9,600	10,000	12,000	47,200
E. Glycol and polyglycol						
End 1940	12,000	.....	.....	10,800	7,200	30,000
Start 1942	12,000	.....	.....	10,800	7,200	30,000
F. Ethylenechlorhydrin, 100%						
End 1940	720	.....	.....	.....	.....	720
Start 1942	1,200	.....	.....	.....	.....	1,200
G. Dioxane						
End 1940	60	.....	.....	.....	.....	60
Start 1942	60	.....	.....	.....	.....	60

The new government owned plant, Anorgana, G.m.b.H. at Gendorf, was to have a rated capacity of 3,000 and 1,000 metric tons of ethylene and ethylene oxide, respectively, per month.

Table VII—Manufacturing Capacity for Plastics, Synthetic Rubber and Fibers

	Capacity (Metric Tons per Month)			
	March 1943	In Construction	Planned	Total
Vinyl Chloride				
Monomer	2,850	600	600	4,050
Polymers				
Igelit PCU	2,100	800	.....	2,900
Igelit MP	200	...	...	200
Igelit PC	210	.....	.....	210
Mowilith D200	20	30	.....	50
Mowilith (new)	.....	60	.....	60
Vinyl Acetate				
Monomer	900	500	.....	1,400
Mowilith block	150	105	.....	255
Mowilith ABC	25	50	.....	75
Mowilith dispersions	800	500	.....	1,300
Appretan	30	20	.....	50
Vinyl Ethers				
Monomers	540	350	.....	890
Polymers				
Oppanol C	90	.....	.....	90
Igevine and Densodrine	310	240	.....	560
Acrylics				
Monomers				
Methyl and ethyl acrylates	300	340	.....	640
Butyl acrylate	100	100	.....	200
Acrylic acid	100	70	.....	170
Polymers				
Acronal dispersions	900	800	.....	1,700
Acronal org. solutions	150	500	.....	650
Acronal, solid	8	22	.....	30
Acronal aqueous solutions (Lactacolle and Collacrole)	65	.....	.....	65
Acrylonitrile	100	930	.....	1,030
Styrene				
Monomers	560	80	.....	640
Polymers				
Polystyrol III and IV	420	.....	.....	.....
Polystyrol EF	120	80	.....	620
Isobutylene				
Monomers	1,695	500	.....	2,195
Polymers				
Oppanol B	750	500	.....	1,250

Table—VII—Manufacturing Capacity (Continued)

	Capacity (Metric Tons per Month)			
	Dec. 1943	In Construction	Planned	Total
Polyamides				
Perlon silk and fibers	130	130	940	1,200
Perlon bristles and screen	85	125	.....	210
Lyafol	118	36	.....	154
Igamid A and B	300	.....	.....	300
Igamid U	5	120	.....	125
Buna Rubber				
Monomers				
Styrene	3,650	.....	750	4,400
Butadiene	11,000	.....	2,250	13,250
Acrylonitrile	100	.....	1,130	1,230
Polymers				
Buna S (incl. buna SS)	8,800	.....	4,865	13,665
Perbunan	750	.....	600	1,350
Buna 85	100	.....	400	500
Buna 32	175	.....	125	300

Table VI—Plastics from Acetylene—Production in Metric Tons

	1941		1942		1943	
	100%	Av. per Mo.	100%	Av. per Mo.	100%	Av. per Mo.
Polyvinyl ethers (Igevine)	2,512	209	3,155	263	2,886	240
Oppanol C	679	57	664	55	710	59
Mowilith solid	1,107	92	1,554	129	1,671	139
Mowilith in solution	373	51/31	595	81/50	588	81/49
Appretan H	124	20/10	132	22/11	83	14/7
Mowilith dispersions (MV incl. MVW)	2,699	513/225	4,169	809/347	4,742	936/395
Mowilith dispersions (Appretan EMW incl. CVW, Mowilith D300, etc.)	124	25/10	158	33/13	163	35/14
Mowilith dispersions (D2 approx. 50% and D200)	.....	.....	28	7/3	123	21/10
Igelit PCU	10,948	912	14,838	1,236	18,383	1,532
Igelit PC	934	78	958	80	1,050	87
Igelit MP	2,200	183	1,813	151	1,419	118
Vinoflex MP 400	174	14	165	14	155	13
Acronal dispersions	3,835	754/320	3,750	743/312	3,277	637,273
Acronal in org. solvents	651	135/54	586	113/49	522	111/44
Polystyrol III, IV, L	4,307	359	4,595	383	4,638	386
Polystyrol EF	95	8	758	63	1,254	104
Oppanol B for plastics	4,138	345	4,719	393	4,358	363
Oppanol B for lub. oil	(298	25)	(363	30)	(384	32)
Total (without Oppanol B for lub. oil)	34,903	.....	42,637	.....	46,022	.....

story of a remarkable development of acetylene chemistry. It was occasioned by mother necessity, in a country, lacking in petroleum reserves and carbohydrate material, which had to base its economy on substitute raw materials and cheap power from the plentiful brown coal.

Although the utilization of acetylene for chemical synthesis had made remarkable strides in Germany during the war, it was believed that only a beginning had been made. Many of the developments of Dr. Reppe were in the laboratory and semiworks stages of development and had not yet been put on commercial scale. It appears that there are great possibilities yet to be developed in utilization of acetylene for chemical manufacture.

COMPRESSOR CONTROL

(*Continued from page 107*)

as noted, automatic control point adjustment is applied only to the 12 high-stage control panels, the low-stage units being remotely adjusted as needed by the manual control buttons on the master panels. From the same master panels manual control can be exercised on the high-stage compressors if desired. Also, manual control of any compressor or manual control point change is possible at each individual speed control panel.

For speed detection each engine is equipped with a small positive displacement pump delivering up to 3 g.p.m. of a special control oil having a comparatively small and uniform change in viscosity with temperature. In addition to the pump the hydraulic system includes for each engine a temperature-compensated orifice within an oil reservoir, an oil filter, relief valve and the necessary connecting tubing. The oil system is closed, with oil delivered by the pump through the orifice to the reservoir, from which it returns to the pump. The orifice, being placed in the reservoir, is at the same temperature as the latter. The orifice size is altered with temperature changes by extruding a tapered needle point through the orifice hole as the temperature rises, or withdrawing it as the temperature falls. The taper and movement of the needle point are the result of careful design and considerable experimentation with the type of oil used.

Now, the pressure on the upstream side of the orifice varies as the square of the engine speed for a given oil temperature and viscosity. This pressure, applied to the ratio controller for each engine, can record on a square root chart of proper range, as a tachometer, directly in engine speed. With the orifice adjusted so that the pressure for full engine speed of 300 r.p.m. equals the full range pressure of the controller, then at one-half speed, 150 r.p.m., the pressure will be one-quarter of the full range of the controller. Adjustable stops on the control mechanism are then set for pressures corresponding to full and half speed so that individual engines will not attempt to run faster or slower than their designed speeds. The output air of each ratio controller is then applied directly through a diaphragm motor to the fuel throttle valve of the engine.

This takes care of maintaining the speed of each engine according to the dictates of its controller. For overall control of the plant the two master control panels are each equipped with a Taylor pneumatic pressure controller, each responding to the suction pressure in its corresponding group of six high-stage compressors, and each acting to reset the control points of the controllers for these compressors if regulation is needed for constant suction pressure maintenance. For changes in system delivery, resetting of the low-stage compressor controllers is accomplished simultaneously by the manual control air valves on the master panels.

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ALCOHOL ECONOMICS

Will Determine Future Production Processes

Most important factor in production of industrial alcohol during normal times is raw material economics; during the past few years war necessity and politics have taken the upper hand. Yet the time is drawing near when orthodox economic factors again will determine which of the newer raw materials and processes are fit for survival. This article, condensed from a larger survey,* gives a comprehensive and impartial analysis of basic production costs for the various processes now in use.—*Editors*

BECAUSE OF the development of wartime processes, the alcohol industry is now faced with potential competition from raw material sources not previously utilized in this country. New plants have been built to produce alcohol from grain, waste sulphite liquor, and wood waste; facilities for producing this chemical from ethylene have been expanded. Considerable experimentation with new processes and raw materials has taken place, and some of these processes were in an advanced stage of development by the end of the war. The time is not far away when it will be determined whether they can compete on an equal cost basis with the prewar established processes using molasses and ethylene. The analyses in this study are intended to indicate relative rather than total costs of production. Thus, the only elements of cost which are considered are raw materials, manufacturing or conversion expenses, and depreciation of plant and equipment. Administrative overhead, selling expenses, freight absorption, cost of denaturation and profit are not included.

ALCOHOL FROM ETHYLENE

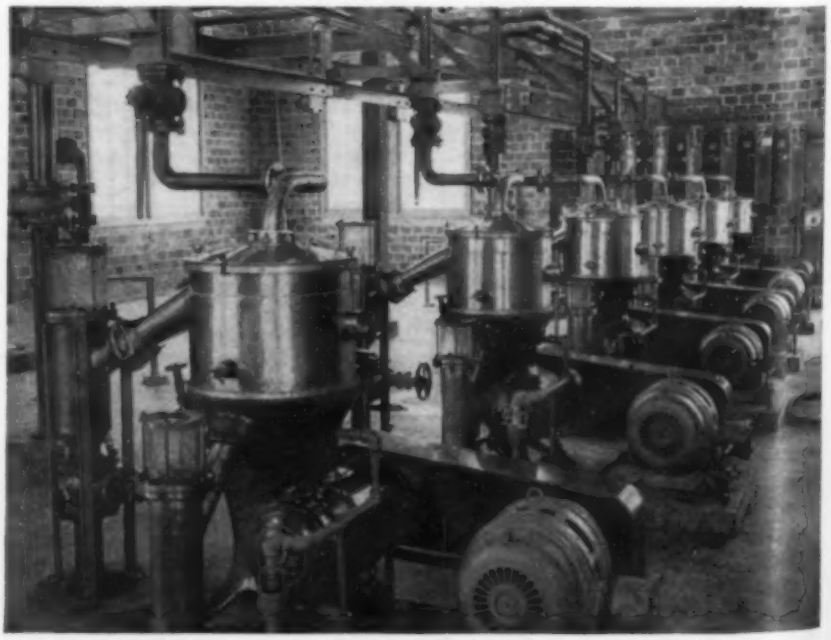
Ethylene from the cracking of petroleum hydrocarbons is generally considered to be the cheapest source of ethyl alcohol. No reliable costs fof this process have been released and it is especially difficult to arrive at a valid figure since other chemical raw materials are obtained in the cracking process. The problem of joint costs is involved, and hence the cost of ethylene is likely to be a function of the particular accounting procedure used.

The cost of ethylene also may be affected appreciably by alternate uses to which it may be directed. In the past, much ethylene has been used for fuel; hence its value as a fuel, based primarily upon the price of substitutes, might be an important factor in determining its cost as a raw material for alcohol. Ethylene will also find increasing usage as a raw material for the chemical industry. If its utilization for other chemical products is more profitable than for alcohol, obviously the price of alcohol will be higher.

Pure ethylene has been charged to government-owned styrene plans at 6c. per lb., but the Office of Rubber Director has stated that it should be available after the war at 2c. to 3c. per lb. In all probability, the cost of 6c. includes unusually high depreciation and other wartime costs. Since the plant investment required for separation and purification of ethylene is substantial, the use of a 3-year depreciation schedule would greatly increase total costs over those for a peacetime plant depreciated on a 10-year basis.

Since each cent for pure ethylene is equivalent approximately to 4c. per gal. of alcohol, 3-cent ethylene represents a cost of 12c. per gal. of alcohol. The additional cost of processing pure ethylene into alco-

Battery of seven beer centrifuges showing piping with explosion-proof motor starters on back wall at new sulphite liquor alcohol plant of Puget Sound Pulp & Paper Co.



* This article is a condensation from one chapter of Dr Tousley's 69-page study "The Economics of Industrial Alcohol" just made available by the Bureau of Economic and Business Research, State College of Washington, Pullman, Wash. The complete study should be consulted for original sources of information contained in this article and for further details on the alcohol industry, including the Pacific Northwest, its prewar and present status, price trends, markets, raw material and production economics.

hol is estimated at more than 2c. per gal., including depreciation on the alcohol-producing equipment over 10 years. Thus the maximum alcohol cost would be 14c. per gal.

Most trade estimates of the present cost of producing synthetic alcohol, including raw material, processing, and depreciation, range between 13-14c. Moreover, it has been established that some synthetic alcohol has been sold in large quantities during the war period at 18c. per gal. Thus, it is logical to conclude that the present cost of producing synthetic alcohol is 13-14c. per gal. but that it might be reduced to 9-10c. if the price of pure ethylene were reduced to 2c.

FROM MOLASSES

Principal expense in the production of alcohol from molasses is the raw material. Since the price of molasses varies considerably according to market conditions, it is not possible to estimate the production cost of molasses alcohol without assuming a definite raw material cost. It is customary to assume blackstrap molasses at 5c. per gal. Since it takes about 2.5 gal. of blackstrap to produce a gallon of alcohol, the raw material cost alone would amount to 12.5c. per gal. of alcohol. Conversion cost, including depreciation on a 10-year basis, would range from 3-4c. per gal., making cost of production approximately 16c. per gal.

Postwar conversion costs for molasses alcohol should not vary greatly from these figures. The present process is relatively efficient, although a small improvement in yield might be obtained. Whether the recovery of additional byproducts will lower conversion costs is still debatable since little has been done in the past to recover such byproducts as protein feed for livestock, carbon dioxide, and similar items. Some persons maintain that returns from the byproducts will no more than cover the added costs of obtaining them. The trend, however, is definitely in the direction of byproduct recovery, and some authorities go so far as to say that ethyl alcohol will be a byproduct in the future.

A study of the price history of molasses since World War I leads to two conclusions: (1) The price of blackstrap follows closely changes in general business conditions; (2) the long-run price trend has been downward since 1930. This has been influenced no doubt by the industrial development of synthetic alcohol. During the postwar period, we may expect the price of molasses to be sufficiently low to permit producers of molasses alcohol to compete with producers of synthetic unless such a price will not cover direct costs of handling and shipping, or alternative uses for molasses are developed which will return a higher price to the producer than can be paid by the alcohol companies.

Direct costs of handling and shipping molasses from the West Indies to North Atlantic ports might range up to 3c. per gal. Peacetime tanker rates to the Atlantic Seaboard were 0.875-1.5c. per gal. Rates to New Orleans were lower on the average by at least 0.25c. Handling molasses in the West Indies provides an additional cost which is dependent upon wage rates and the location of the refinery in relation to port facilities. In some cases, this cost has exceeded 2c. per gal.

The price of molasses eventually may be less than 5c. per gal., precedent for such a price being found in the levels attained after World War I when molasses sold for more than a year at less than this figure. Most alcohol producers state that the price of molasses must be reduced to permit them to compete with synthetic alcohol, the statement probably being based on the assumption that the cost of synthetic alcohol will remain approximately at present levels.

ALCOHOL FROM GRAIN

Alcohol from grain generally has been more costly than that from molasses, since: (1) The raw material usually has been more expensive, although at times prices were sufficiently low to permit grain to compete; (2) the processing cost is somewhat higher than for molasses, since the starch must first be converted into sugar. Malt used in this conversion increases the cost of alcohol from grain by at least 4c. per gal. and the plant investment is somewhat higher. Offsetting these higher costs in part, are byproduct values which are considerably greater than from molasses. As a result, grain alcohol has been used primarily for beverage purposes.

Two research studies have been published on the cost of producing alcohol from grain. Both are primarily concerned with corn, but the figures are applicable to other grains except that yields are probably somewhat lower. The first study was made in 1938 by the U. S. Department of Agriculture; the second was published in 1940 by the Iowa Agricultural Experiment Station. The following summarizes the production cost of alcohol as computed in these two studies:

	Department of Agriculture	Iowa Agricultural Experiment Station
	Cents per Gal.	
Corn at 50c per bu.	24.40	20.00*
Malt		4.18
Processing cost including depreciation and interest	7.50	6.36
Total	31.90	30.54
Less credit for byproducts	5.10	7.50
Net cost	26.80	23.04

* Converted by the writer to place on a comparable basis.

These net cost figures include interest on investment and, in the Department of Agriculture study at least, certain administrative expenses not included in the "cost of production" as defined in this article. On the other hand, depreciation in the Department of Agriculture analysis is on a more conservative basis than the 10-year period used in this study.

Many unsubstantiated claims have been made since the beginning of World War II of improved processes that will lower the cost of alcohol from grain by 10-15c. per gal. Experiments at the Northern Regional Research Laboratory have thus far failed to indicate that costs can be greatly reduced.

Minimum cost of production, as defined in this report, for alcohol from corn is probably between 20.5-23.5c. per gal. Assuming corn at 45c. and a yield at 2.5 gal. of alcohol per bu., raw material cost would be 18c. per gal. Cost of malt will be between 4-5c. per gal. of alcohol, and processing costs including depreciation on a 10-year basis will probably vary between 6-7c. A byproduct credit of 6.5-7.5c. per gal. of alcohol would give a net cost of 20.5-23.5c.

Principal problem in production of grain alcohol is the fluctuating cost of raw material. In the above illustration, the price for corn was assumed at 45c. per bu. This was the approximate level prevailing between 1937-1939 for the lower grades ordinarily used by the processing industries. Between 1934-1936, however, the price averaged considerably higher, and between 1920-1940 there were not more than 9 or 10 years in which corn could have been purchased consistently at 50c. per bu. or less.

Grain alcohol plants have the further disadvantage that the price of raw material fluctuates considerably and is governed by factors completely beyond their control. Although the cost of molasses has fluctuated widely, at least the demand for molasses by alcohol producers is an important stabilizing factor. Thus, there is some relationship between the price of molasses and the demand for alcohol; this is not true in the case of grain.

The outloook for production of alcohol from grain, therefore, does not appear to be favorable unless costs can be reduced. The government is committed to support prices of agricultural products for at least two years after the war. Even after this period, low prices for agricultural products are not likely to be politically feasible.

SULPHITE LIQUOR ALCOHOL

Production of alcohol from waste sulphite liquor of pulp mills has been common practice in Europe but development in the United States has been retarded because of inability to compete with the molasses process. The only sulphite liquor plant that operated in this country prior to World War II was constructed in 1915 at Mechanicville, N. Y. Presumabily this was unprofitable since the plant was eventually dismantled. The experience of this plant

is not a fair criterion of the economic possibilities, however, especially since process improvements have been made in recent years.

Renewed interest in the sulphite liquor process was stimulated as a result of wartime demand for alcohol. In June, 1943, the Ontario Paper Co. of Thorold, Ontario, began operation of a plant with an annual capacity of approximately 600,000 gal. In February, 1945, the Puget Sound Pulp and Timber Co. of Bellingham, Wash., started operation of a larger plant financed and owned by DPC. This plant is designed to produce about 5,500 gal. of alcohol per day compared with actual production at Thorold during October and November, 1943, of about 1,700 gal. per day.

Most estimates of the production cost of alcohol from waste sulphite liquor have been based upon the experience of the Thorold plant. None of the published figures reveal exact costs at Thorold, but rather are computations for plants of different sizes according to the operating data available from Thorold. These estimates are shown in an accompanying table. In all cases, they assume 65 percent recovery of sulphite liquor from the blow pits and a fermentable sugar content of 1.5 percent. The yield at Thorold under these conditions has been 18 gal. of alcohol per ton of pulp. It is claimed that with additional equipment, recovery of liquor can be increased from 65 to 90 percent. This would give 25 gal. of alcohol per ton of pulp. It is estimated that this yield would decrease total costs by about 8c. per gal.

According to the estimates, production cost of alcohol from waste sulphite liquor would range from approximately 20 to perhaps 27c. per gal., depending upon the size of the plant. No value is assigned to the raw material.

There are in the State of Washington eight pulp mills which produce 200 or more tons of pulp daily. About half of these produce 300 or more tons per day, from which approximately 5,500 gal. of alcohol could be produced. The following estimates for conversion costs of alcohol are given for mills of this size, based upon a fermentable sugar content of 1.5 percent and a yield of 18 gal. of alcohol per ton of pulp.

	Cents per Gal.
Lime	2.4 – 2.5
Other chemicals	0.4 – 0.5
Steam	2.25– 4.5
Electric power	0.5 – 0.6
Labor	2.5 – 3.0
Supervision & maintenance	1.5 – 2.0
Total	9.55–13.1

These costs are below those presented in the table with respect to steam and labor and higher with respect to lime. Steam costs in the Washington plants studied, range from 15-30c. per 1,000 lb. compared with 40c. in the Thorold estimates. Lime is about twice as expensive in Washington, even in normal times, as the 0.35c. per lb. used in the other estimates. Lower labor costs merely reflect savings due to size of operation.

To arrive at the production cost, it is necessary to add depreciation charges to the above conversion costs. The estimates of Hall and Aries amount to 7.7c. per gal. on a 10-yr. basis. This assumes a total construction cost of $500,000 for a plant of about 650,000 gal. annual capacity, which is based on the Thorold figures. The Bellingham plant, however, cost $1,100,000 for an annual capacity of almost 2,000,000 gal. At prewar wage rates and material prices, it could probably have been constructed for about $800,000.

Depreciation over 10 years for a plant costing $550,000 per million gal. of annual capacity (the approximate cost at Bellingham) will add 5.5c. to the conversion cost. Thus, we have a total production cost of some 15-19c. per gal. for alcohol from waste sulphite liquor by larger pulp mills of the Pacific Northwest. Obviously, these figures include a certain amount of wartime inflation. In the postwar period, it is possible that costs might be as much as 2c. per gal. lower. Depreciation should be less for new plants as a result of lower construction costs; labor costs might also be less.

These figures apply only to plants in the Pacific Northwest which can produce in the neighborhood of 5,000 gal. of alcohol daily. This quantity of product, at present alcohol yields, would require a pulp capacity of some 275 tons daily. A pulp plant with a capacity of 200 tons would probably have a cost 2-3c. higher, principally in labor and depreciation.

ALCOHOL FROM WOOD WASTE

Production of ethyl alcohol from wood waste is not new. During World War I, several million gallons were thus produced. Methods used, however, resulted in a low yield of alcohol at a comparatively high cost. The plants were closed after the war because they were unable to compete with molasses plants.

Improved processes of wood hydrolysis developed by Scholler in Germany during the late 1920's resulted in a much higher yield as a result, wood-hydrolysis plants were soon established rather widely in Germany and to a lesser extent in other countries. Information on the Scholler process was made available in 1940 and 1941 to our government by German chemists residing in this country. A pilot plant was established for experimental purposes by the Forest Products Laboratory at Marquette, Wis.

The result of this and other research has been the development of a modified Scholler process, adaptable to production conditions in the United States and reportedly superior to the German method. In 1944 WPB approved construction of a wood hydrolysis plant at Springfield, Ore. This plant, financed and owned by DPC, is being built and will be operated by the Willamette Valley Wood Chemical Co. It will have a capacity of about 11,500 gal. of alcohol daily from some 230 tons (dry basis) of wood waste. Cost data available thus far, based on pilot plant operations instead of actual commercial production, are tentative and subject to confirmation. (Since this was written DPC has stopped construction of this plant.)

Raw materials constitute an important cost element for alcohol produced by the wood hydrolysis method. An economic plant requires about 200 tons of dry wood substance daily. It is generally agreed that the cost of wood waste at the plant must not exceed $2.00 per ton dry basis, which restricts the radius within which the material must be obtained to 25-30 miles from the plant.

Other raw materials are required in addition to the wood. A plant converting 20 tons of dry wood daily consumes in the

Estimated Costs of Producing Alcohol from Waste Sulphite Liquor
Cents per Gal.

Cost Element	Plant of Minimum Size, 1,200 Gal. Daily	Plant of Average Size, 4,000 Gal. Daily	Plant of Thorold Size, 1,800 Gal. Daily	Plant of Thorold Size, 1,800 Gal. Daily
Estimator	Rosten	Rosten	Hall	Aries
Conversion costs:				
Lime (3.4 lb. per gal. at @ 0.35 c. per lb.)	1.2	1.2	1.19	1.10
Steam (at 40 c. per 1,000 lb.)*	6.0	6.0	7.20	6.00
Labor (at $1 per hr.)	8.0	2.65	5.33	5.40
Power (1.5 kwh. per gal.)	0.75	0.75	0.75	0.375
Chemicals	....	....	0.45	0.382
Supervision	2.0	0.6	....	.....
Incidentals	1.8	1.2	....	.....
Total conversion cost	19.75	12.40	14.92	13.257
Overhead costs:				
Amortization (10 years at $50,000)			7.7	7.7
Interest (at 5 percent)			3.9	3.9
Taxes (2.5 percent)			2.0	....
Supervision and maintenance			3.0	2.0
Total costs			31.52	26.857

* Three estimates use 150 lb. of steam per gal. of alcohol; the other uses 180 lb. None makes allowance for heat recovery and charge back to pulp mill. It is claimed that steam consumption could be reduced to 110 or 120 lb. per gal. if this allowance were made.

same time 10 tons of sulphuric acid, 6 tons of burnt lime, and 2,000,000 gal. of water. Other chemicals are required in smaller quantities. The yield of alcohol is estimated at 50-60 gal. per ton of wood substance. A yield of at least 55 gal. should be obtained from pure wood, but in practice the general run of sawmill waste will include a certain amount of bark which is much less productive. For this reason, operators of the Springfield plant expect to obtain a yield of only 48 gal. of alcohol per ton of waste.

In addition, expenses of labor, steam, and power must be considered. One authority estimates a labor force of 60 men for a plant of the size described and an annual outlay of $200,000 for wages, including supervision and administration. Steam and power may not add greatly to the cost because the lignin resulting from the hydrolysis (600 lb. per ton of waste) can be used for fuel. An additional amount of wood waste, however, is necessary to supplement the lignin. For the Springfield plant, this is estimated at 25 tons daily, or about 10 percent of the amount of waste being processed.

Estimates of processing costs of alcohol from wood waste have been published by J. A. Hall of the U. S. Forest Service and by Eduard Farber of Timber Engineering Co. Hall's estimate is based on a yield of 50 gal. of alcohol per ton of wood, whereas Farber's assumes a yield of 55 gal. The estimates follow:

	Hall	Farber
	Cents per Gal.	
Wood at $2 per dry ton	4.00	3.64
Steam and power	1.00	....
Chemicals	2.07	3.00
Water	1.00	1.00
Labor	5.76*	5.00‡
Total conversion cost	13.83	12.64

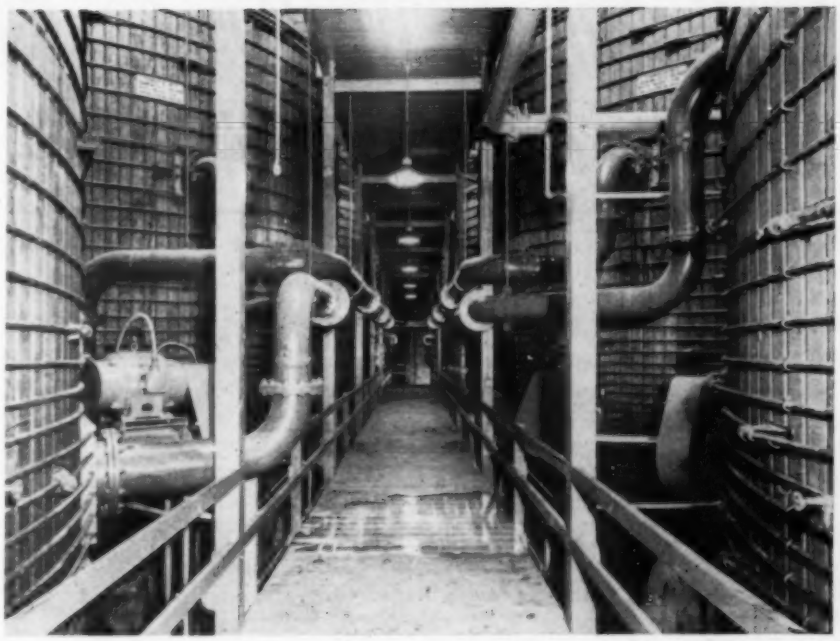
* $1 per hr. ‡ $200,000 per yr.

On the basis of 48 gal. per ton of wood rather than 55 gal., Farber's estimate would be increased to about 14.5c. An additional cost of about 0.5c. for steam and power is indicated on the basis of the Springfield estimates of additional wood waste necessary for that purpose.

An estimate by R. S. Aries, based on a yield of 50 gal. per ton of wood, arrives at a somewhat higher cost:

	Cents per Gal
Wood waste	4.00
Chemicals	2.00
Water, steam, power	4.07
Wages	4.00
Salaries and general overhead	1.50
Repairs and maintenance	1.67
Total	17.84

Although these estimates, especially those of Farber and Aries, may include some items of administrative overhead not included in the cost of production as defined herein, inclusion of an allowance for repairs and maintenance would give a conversion cost of at least 15-16c. per gal. of alcohol. Depreciation on a 10-year basis would add 5.5-6c. per gal. at present costs.



Fermenter tanks, piping and agitators from lower walkway at sulphite liquor alcohol plant of Puget Sound Pulp & Paper Co.

Most persons interested in production of alcohol from wood waste emphasize the potential importance of byproduct recovery; many say that economic feasibility of wood hydrolysis depends upon successful utilization of byproducts. If the various estimates on production costs already given are even approximately correct, there is justification for such a statement. There are several possibilities for successful byproduct recovery from wood hydrolysis:

(1) Recovery of products such as acetic acid and furfural. Some additional cost would be incurred in obtaining these but the net result (assuming the existence of a ready market) should reduce the cost of alcohol.

(2) Utilization of unfermented sugars. This is a difficult problem which is receiving much attention at present.

(3) Commercial utilization of lignin. Suggestions have been made that lignin might be used in plastics, but research has failed thus far to find suitable application. Some believe greater possibilities exist in its use as a fertilizer or in its hydrogenolysis to product methyl alcohol and mixed phenols. A great deal of research is under way in this field and it is reasonable to assume that commercial possibilities will be discovered. However, fuel costs incurred in producing alcohol would be increased by the diversion of lignin to other uses, and costs of processing the lignin and the resulting products would have to be covered by the price obtained for commercial products.

Purpose of this study is to show relative costs of producing alcohol from various raw materials. Accordingly, data presented include only the cost of raw materials, processing and depreciation. Not included are such factors as administrative overhead, selling expenses, freight absorption, cost of denaturation and profit. On this basis the following cost estimates may be made:

(1) With total cost of pure ethylene at 3c. per lb., cost of synthetic alcohol would be 13-14c. per gal. If ethylene is made available at 2c. per lb., cost of synthetic alcohol probably will be 10c. per gal. or less.

(2) With a molasses cost of 5c. per gal., cost of molasses alcohol would be about 16c. per gal.

(3) Assuming corn at 45c. per bu., cost of grain alcohol would be 20.5-23.5c. per gal. Price of corn will probably be higher for a number of years.

(4) For relatively large plants of 300 tons of pulp per day, present cost of alcohol from waste sulphite liquor is estimated at 15-19c. per gal. Postwar costs would be lower by at least 2c. per gal.

(5) Assuming a waste wood cost of $2.00 per ton dry basis f.o.b. processing plant, estimated cost of wood hydrolysis alcohol would be 20.5-22c. per gal.

Therefore, provided the raw material price is sufficiently low, molasses alcohol should be able to compete successfully with the synthetic product. If ethylene should approach 2c. per lb., molasses alcohol producers would require a raw material price of about 3c. per gal. in order to compete. Alcohol from waste sulphite liquor should be able to compete with alcohol from 5c. molasses, provided plants are located equally accessible to the markets. Grain and wood waste appear to be relatively high cost sources.

FROM THE VIEWPOINT OF THE EDITORS—

S. D. KIRKPATRICK, Editor • JAMES A. LEE, Managing Editor • THEODORE R. OLIVE, J. R. CALLAHAM, Associate Editors • HENRY M. BATTERS, Market Editor
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CAN WE HAVE A "MILD" INFLATION?

EACH major war for the last 5,000 years has been followed by a greater or lesser degree of inflation. Most of us remember what happened after World War I when commodity prices first dropped rather sharply in December, January and February, only to begin a rapid rise in March, 1919, that carried them to new peaks and led finally to the inevitable collapse ten years later. Some observers, including the *New York Times*, believe that the present economic situation differs in so many ways from that of 1919 that we may still avoid a postwar splurge. Others, including Chester Bowles, administrator of OPA, feel it is time to sound a note of warning against those who seem to favor a "mild" inflation.

A substantial number of business men, according to Mr. Bowles, have been willing to agree in theory to overall price control, but have argued that a 5, 10 or 15 percent increase in the general price level would not really constitute an inflation—that it might even be a good thing and furnish a healthy stimulus to our economy. They ignore the fact that one man's prices are another's costs, that once the general upward movement of prices begins the situation could rapidly get out of hand. Labor, which is currently arguing that wage increases are possible with no increase in prices, would certainly multiply its demands many fold if the proposed "gentle" inflation was permitted. Nor would the farmer tolerate any increase in industrial prices without a corresponding increase in farm income.

When one takes into account the attitudes and reactions of all groups which go to make up our economy, it becomes obvious that those who advocate a "mild" inflation are talking pure theory, and highly dangerous theory at that. No one could hope to administer or control such a force once it got under way. The best time to stop it is before it starts.

REVITALIZING COMMERCE

NOT since the Hoover secretaryship has there been so much hope and enthusiasm among the rank and file in the Department of Commerce. With whatever misgivings the outside business world regarded the Wallace appointment, it is evident within the organization that he is already exerting vigorous leadership in reshaping old policies and procedures and supplementing them with important new fields of activity. That these are of immediate and practical interest to American industry is scarcely debatable.

Secretary Wallace, in a press conference on September 20, outlined a six-point program to improve the volume and quality of the services of the department and, in addition, to increase its technological and research functions, especially for small business. (How much politics and demagoguery will enter into the latter activities remains to be demonstrated.) The new program would (1) revitalize foreign trade services to promote a higher level of exports and imports, (2) provide a stronger, balanced program of current and "benchmark" statistics, (3) correlate, analyze and interpret current information on the economic and business outlook, (4) increase technological aids and services to business, especially small business, (5) increase management aids such as market analyses and studies of trade conditions and (6) strengthen the technical and research services of existing bureaus by extending cooperative projects to laboratories in universities and industries.

For some of this program the department will need additional legislation and funds but those who recall the secretary's vigorous sponsorship of the Department of Agriculture will realize that he is a persistent, indefatigable champion of causes. For some of us he is still on trial but no one should be so blind as to refuse to see what is being done to bring the department back to the useful place it occupied prior to 1933.

HONORS TO BOMB MAKERS

DOWN in "Dogpatch" (code name for Oak Ridge, Tenn.) on September 29 there was a unique celebration. More than 70,000 workers in nine companies participated in one of the largest Army-Navy "E" award ceremonies. The companies thus honored for their contribution to the atomic bomb project were the Kellex Corp., Tennessee Eastman Corp., J. H. Jones Construction Co., Carbide & Carbon Chemicals Corp., The Fercleve Corp., Clinton Laboratories of Monsanto Chemical Co., Ford, Bacon & Davis, Inc., Stone & Webster Engineering Corp., and H. K. Ferguson Corp. Each of the men and women who helped design the equipment, develop the processes, construct and operate the huge plants at Oak Ridge received a token of appreciation from the Armed Services. With it went the gratitude of all who understand the historic importance of this great cooperative pooling of knowledge and effort.

QUICK DECISIONS, PRO AND CON

CHEMICAL ENGINEERS are frequently going to be confronted with the need for quick decisions in many chemical and personnel questions. The old war habit will not die easily. It came from the necessity for doing something immediately, even when all the facts were not available. It will stay with us for some time.

This war habit of quick decision will be of value if it is kept as a means of speeding up action without sacrifice of judgment based on adequate information and knowledge.

In prewar days there was far too much tendency to think that many decisions about research programs and technical personnel "can wait." It would be wise not to revert to that dilatory practice.

In the hiring of personnel to rebuild research, development and technical operating staffs of companies there remains urgent need for promptness. There is greater demand than supply for this professional brainpower. It will be important that industrial executives do not lose good men by being too hesitant in making their proposals and employment arrangements.

But in peace times, action is rarely so urgently needed that one is justified in making purely technical decisions on the basis of inadequate information. Any decision at all was better than none in the war period. This is no longer true. A sound but delayed decision is usually much better than a quick decision which involves considerable uncertainty. Perhaps chemical engineers will have to come out bluntly and say this from time to time as part of the job of reconverting from wartime habits.

FACILITIES FOR WORKERS

Provision of general plant facilties for ventilation, heating, washrooms, lockers, and luncheon space is not normally a job for the chemical engineer. But more and more these factors in security and comfort for the workers are becoming important. It has now reached the point that the chemical engineer is just as negligent if he does not see that there are such plant facilities as if he were to neglect some essential phase of process equipment or control.

This fact is now often spotlighted by the demands of union organizations. In one recent case the unions placed at the top of their list of demands the establishment of such facilities. Incidentally, the purpose of the whole list offered by the union was nominally the getting of greater output from the plant, which shows the mutual benefit to workers and stockholders.

Realistic appraisal of these factors of workers' comfort will often show that economy in dollars invested at the outset is very costly in the over-all balance sheet. Furthermore, inadequate workers' facilities are certainly altogether unwarranted from the standpoint of good management and sound cooperative labor relations.

ATOMIC BOMB BYPRODUCTS

In the midst of the tremendously onerous problems in future administration that are the most obvious byproducts of our success with the atomic bomb, there are also immediate and enormous benefits to engineering that might never have been achieved without its development. Even disregarding the possibilities for peacetime utilization of nuclear energy (which according to so high an authority as Dr. A. H. Compton may be much closer than some have believed), it seems likely that these other benefits are in themselves worth at least the entire cost of the development up to this point. Some of these benefits were described recently by Kellex Corp., special non-profit subsidiary of the M. W. Kellogg Co., and guiding genius behind the gaseous diffusion plant at Oak Ridge.

Doubtless the most valuable of these byproducts are the new engineering techniques and the new equipment, of which at least 5,000 items have been counted by Kellex. Gaseous diffusion, for example, has been so radically perfected that it is expected to become a serious competitor for distillation and other separation methods at many points in the chemical and petroleum industries. It must be remembered that the U-235 separation involves a mass difference of only slightly less than 1 percent, whereas in most separations a much greater difference will mean vastly smaller equipment. Then, too, there are developments of great importance in pumps and compressors, in methods of shaft packing and sealing, in high vacuum production, and in instruments for leak detection and other purposes.

Still another class of byproducts includes the presently wasted radioactive materials that are produced in quantity in the plutonium synthesis. Not only are these materials expected to provide cheap and abundant sources of radioactivity for medical and industrial use, but it also seems quite likely that radioactive elements of suitable character can be produced intentionally by subjecting metals or other materials of suitable composition and physical form to the activity within or adjacent to an operating plutonium pile. On this account it has even been suggested that radium itself may cease to be an article of commerce and that the expense entailed in producing high voltage X-rays need no longer be incurred, once the new radioactive byproducts can be moved into medical and industrial channels.

How to utilize the byproducts of improved engineering technique and equipment without revealing the secrets incident to producing the bomb's raw materials is, of course, the big problem. If, as the scientists who worked on the project assure us, the engineering techniques are actually our only secrets, some little time may elapse before information of this character can be released generally. Nevertheless, release must come sometime. Meanwhile thousands of engineers returning from the project to their normal peacetime pursuits cannot help but apply some of what they have learned to totally different peacetime purposes.

GRANTS FOR RESEARCH

At a time when colleges and universities are faced with the almost impossible task of building up their depleted faculties, due to more attractive renumeration from industry, an announcement of a fund of $2,500,000 to be granted for research and teaching is extremely opportune. The grants of the Research Corporation of New York, a non-profit organization devoted to advancing research by use of revenues from inventions assigned to it by public spirited inventors, will be made to institutions for the next five-year period, usually in sums of $2,500 to $5,000 for an academic year, to support research in chemistry, physics, mathematics and engineering. The funds will be available for purchase of equipment and for employment of assistants either as fellows or otherwise. Preference will be given, other factors being equal, to smaller institutions and those of more limited financial resources for research. Applications for grants to their institutions will be entertained from persons of proved research ability who are desirous of entering or reentering the faculties of institutions of learning.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

$50 WAR BOND FOR A GOOD IDEA!

Until further notice the editors of *Chem. & Met.* will award a $50 Series E War Bond each month to the author of the best short article received during the *preceding* month and accepted for publication in the *"Chem. & Met. Plant Notebook."* Articles will be judged during the month following receipt, and the award announced in the issue of that month. The judges will be the editors of *Chem. & Met.* Non-winning articles submitted for this contest may be published if acceptable, and if published will be paid for at space rates applying to this department. (Right is reserved, however, to make no award in months when no article received is of award status.)

Any reader of *Chem. & Met.*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are criteria of the judging.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address entries to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N.Y.

SEPTEMBER WINNER!

A $50 Series E War Bond will be issued in the name of

J. A. MAY
Chemical Engineer
Lake Jackson, Texas

For an article dealing with a simple jet pump of non-metallic materials for corrosive liquids, which has been judged the winner of our September contest.

This article will appear in our November issue. Watch for it!

August Contest Prize Winner

DETERMINING PUMP DISCHARGE BY HEIGHT OF STREAM FROM VERTICAL OPEN-END PIPE

FOSTER C. BENNETT
Metallurgical Department
Dow Chemical Co.
Midland, Mich.

IN CHEMICAL ENGINEERING work it frequently becomes necessary to determine the characteristic discharge curve of a centrifugal pump or of a pumping system. This can be done by filling a tank of known volume while recording the pump delivery pressure and the elapsed time. However, this takes a great deal of time and the pump does not always happen to discharge into a tank of known capacity. It is possible to get instantaneous readings of the flow in gallons per minute for any given head by the use of the simple arrangement described here.*

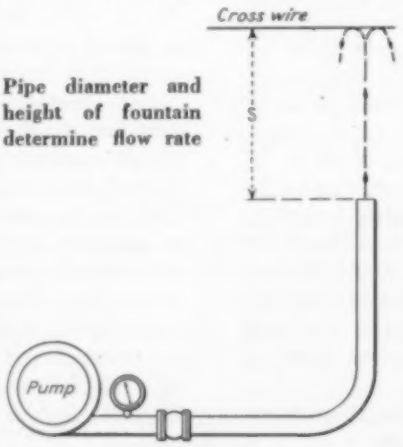
The discharge pipe of the system should be straight for 40 diameters and must be turned into a vertical position to produce a fountain. Then the quantity of water discharged per unit of time is a function of the pipe diameter and the height of the fountain, provided the outlet is not submerged. This relation can be derived mathematically with the following result:

$$Q = 19.6\, CD^2 \sqrt{s}$$

where Q = flow in gallons per minute; D = pipe diameter in inches; and s = fountain height in feet.

If the pump discharges through a section of pipe, the value of C will be 0.98. However, if a sharp-edged orifice is used at the exit, a good average value for C is 0.63. This holds for orifices from 1 to 2½ in. in diameter.

The method is good for use on any steady pressure source. For example, if it is desired to calibrate a centrifugal pump, the outlet is arranged with a valve and pressure gage and a vertical pipe outlet. Cross bars or wires can be placed at convenient heights or values of s. Then the flow is adjusted to give a fountain just wetting a cross-wire at which time a pressure reading is taken. Calculation of the flow then give the desired values for the conventional graph of head vs. flow. Repeat the procedure for various values of s to get the complete curve.



Pipe diameter and height of fountain determine flow rate

The accuracy of the results depends upon the condition of the discharge pipe and to a lesser extent upon the determination of s. A mill tolerance of −0.010 in. on the pipe, plus a reading allowance of 1 in. on s will give values of Q about 2.5 percent low. However, if readings of s are made to the very top of the fountain the error made will tend to compensate the orifice error giving the flow within 1.5 percent of the correct value.

CALCULATION OF ERROR

In the case of the pipe discharge the coefficient C is close to unity so the equation to be considered is:

$$Q = 19.6\, D^2 \sqrt{s}$$

Taking the partial derivative with respect to D:

$$\delta Q/\delta D = 39.2\, D\sqrt{s}$$

Taking the partial derivative with respect to s:

$$\delta Q/\delta s = 9.8\, D^2/\sqrt{s}$$

Therefore:

$$\Delta Q = 39.2\, D\sqrt{s}\,\Delta D + 9.8 D^2 \Delta s/\sqrt{s}$$

Case I: $D = 1$ in. Possible error: −0.010 in.; $s = 2$ ft. Possible error: −0.020 ft.

$$\Delta Q = 39.2\,(1)\,\sqrt{2}\,(-0.010) \pm 9.8\,(1)^2\,(0.02)/\sqrt{s}$$

The maximum error would occur when both signs are negative. Therefore: $\Delta Q = 0.694$ g.p.m. and $Q = 27.7$ g.p.m. Therefore: $0.694/27.7 \times 100 = -2.5$ percent maximum probable error.

* Sometimes the method of using the throw of a horizontal stream, as explained by Robert L. Miller on page 117 of our July 1945 number, is not convenient. Such a case prompted Mr. Bennett to work out the method discussed here. Thus an essentially novel adaptation of an old and useful device has been evolved.—*Editor.*

Up-Ender for Drums and Barrels

One plant, according to the Compressed Air Institute, found a simple and effective solution to the problem of up-ending heavy drums on its loading dock. The half-ton drums are rolled to the air-operated lift where the air pressure, controlled by a three-way air valve and pushing on the piston of an old double-acting, cylinder-type air hoist which has been converted as shown, shoves the drum upright like a match stick.

Case II: $D = 1$ in. Possible error: −0.010 in.; $s = 10$ ft. Possible error: −0.080 ft.

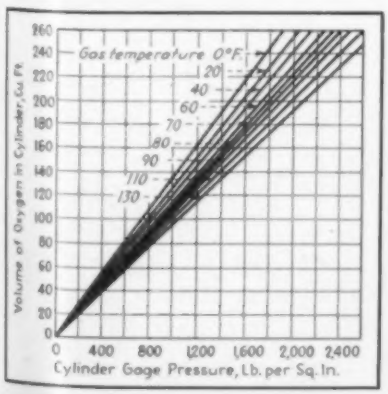
$$\Delta Q = 39.2\,(1)\,\sqrt{10}\,(-0.010) - 9.8\,(1)\,(0.08)/\sqrt{10}$$

Therefore: $\Delta Q = -1.49$ g.p.m. and $Q = 62$ g.p.m. Therefore: $-1.49/62 \times 100 = -2.4$ percent max. probable error.

Case III: $D = 2.5$ in. Possible error: 0.010 in.; $s = 10$ ft. Possible error: −0.080 ft.

Oxygen Volume Chart

A convenient way of estimating the volume of oxygen remaining in a standard oxygen cylinder is to use the accompanying chart appearing in a recent issue of *Oxy-Acetylene Tips*, published by Linde Air Products Co. A similar chart can, of course, be readily prepared for other gases of known vapor pressure, in pressure containers of known size. Using the chart given here it is claimed that the user, a welding and cutting operator, for example, can estimate the cylinder contents within 5 or 10 cu. ft. Select the proper line for cylinder temperature and note where the vertical line for the gage pressure crosses it. The point to the left on the vertical scale shows the approximate content of oxygen at standard conditions.



$$\Delta Q = 39.2\,(2.5)\,\sqrt{10}\,(-0.010) + 9.8\,(2.5)^2\,(-0.08)/\sqrt{10}$$

Therefore: $\Delta Q = -4.64$ g.p.m. and $-4.64/385 \times 100 = -1.2$ percent maximum probable error.

FORMULA DERIVATION

Let s = height of vertical jet and V_o = velocity at discharge. Then $s = V_o t - \frac{1}{2} gt^2$, the equation of motion.

$ds/dt = V_o - gt$

When $ds/dt = 0$, $V_o = gt$ or $t = V_o/g$.

At this moment:

$$s = \frac{V_o^2}{g} - \frac{g}{2}\frac{V_o^2}{g^2} = \frac{V_o^2}{2g} \text{ or } V_o^2 = 2gs$$

Let Q = the flow rate in g.p.m. and D = pipe or orifice diameter in inches.

Then $Q = VA$ (cu. ft. per sec.)

$Q = 7.48\,(60)\,VA$ (g.p.m.)

$A = \pi r^2 = 0.7854\,D^2$

$Q = 448\,(0.7854)\,D^2V$

$Q = 352\,D^2V$ (g.p.m.)

$Q = 352\,D^2\sqrt{2gs}$

For D in inches:

$$Q = 19.6\,D^2\sqrt{s} \text{ g.p.m.}$$

Actually a coefficient is required due to energy losses, so

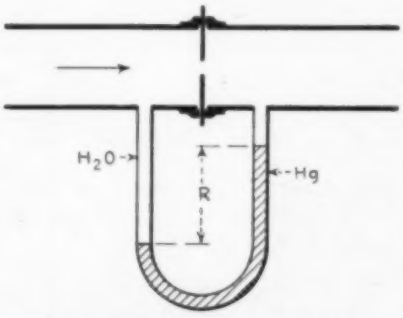
$$Q = 19.6\,CD^2\sqrt{s} \text{ g.p.m.}$$

For pipe use $C = c_v = 0.98$, while, for an orifice, $C = c_v\,c_c = 0.63$.

SLIDE RULE CONVERSION FOR MANOMETER READINGS

MIRO E. KLECKA
Department of Chemical Engineering
University of Texas
Austin, Tex.

FREQUENTLY the flow of water through an orifice or venturi meter is calculated from readings of a mercury manometer of the type illustrated in the accompanying diagram. If water is above the mercury in the legs of the manometer, it is necessary to correct the manometer reading before it can be used in making the usual hydraulic calculations.



Simple conversion is available for a manometer of this type

If the reading of the manometer is in inches of mercury, the pressure drop, in feet of water, can be calculated using the following relation:

$$\Delta H_w = \frac{R}{12}\left(\frac{\rho_{Hg} - \rho_w}{\rho_w}\right).$$

Substituting in the values for the density of mercury and of water at 60 deg. F., the following result is obtained:

$$\Delta H_w = 1.047\,(R) = \frac{21.99}{21.0}\,(R).$$

And at 100 deg. F. the result is:

$$\Delta H_w = 1.042\,(R) = \frac{21.89}{21.0}\,(R).$$

Therefore, the following is suggested as a permanent slide rule setting that is worth remembering. Set 21 on the C scale opposite 22 on the D scale. Then inches of mercury set on the C scale will give the corrected pressure drop in feet of water on the D scale.

The above procedure expedites this type of calculation. The slight error included in the final result, when this ratio is used, is negligible in comparison to the probable error of the manometer reading.

WINDSHIELD WIPER FOR AGITATOR POWER

NORMAN MORASH and W. F. CALDWELL
Development Engineering Div.
American Cyanamid Co.
Stamford, Conn.

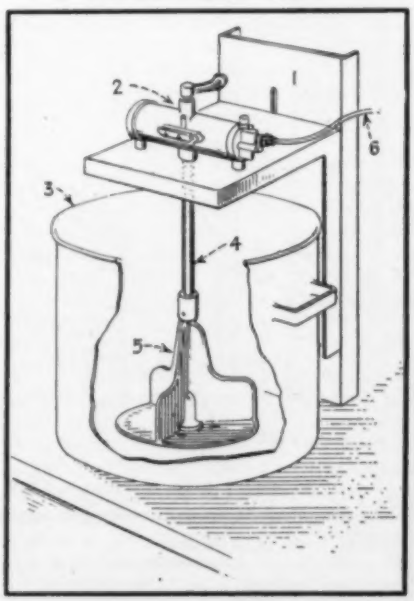
IN RESEARCH laboratories, the need for an inexpensive and simple source of miniature power supply capable of producing a reversible or a reciprocating motion is frequently felt and where low pressure air is available, one of the numerous windshield wipers now on the market will furnish a most adaptable unit for that purpose.

The drawing shown here represents only one of a number of such adaptations in our research laboratories which have proven quite helpful. Its primary purpose was to serve as a small washing machine to be used on samples of textiles which have been treated with various compounds and dyes, but it serves equally well as an agitated tank for various chemical operations. Furthermore, since it is air actuated, there is no explosion hazard when working with volatile solvents.

In general, it is made up of parts which can be readily purchased and light sheet metal that is easily handled.

As shown on the illustration, (1) is a 16-ga. black iron stand fastened to a table.

Windshield wiper agitator



An angle-shaped piece, which is adjustable up or down by means of bolts in slots on the stand, is provided for carrying the wiper (2). The latter is a Trico windshield wiper, Model FP-1000-AR, with 120-deg. stroke, giving a torque of 500 in.-ozs. when operated with 32-lb. air pressure. It is normally operated at about 120 strokes per minute. The tank (3) is 13 in. dia. x 10½ in. high and is made of 16-ga., 18-8 stainless steel. Part (4) is a brass adapter shaft to drive (5) which is a 7-in. aluminum impeller for Type SXV washing machine, purchased as a repair part from Chicago Electric Mfg. Co. This washing machine impeller engages a pin in the center of tank (3) to prevent side sway when in operation. An air strainer is, of course, necessary in air line (6) to prevent scale from getting into the wiper. The total cost of the unit was $35.

CHART FOR CONTRACTION AND ENLARGEMENT LOSSES

MARION MONET and F. R. WARD
Chemical Engineers
Knoxville, Tenn.

WHEN AN ENGINEER is designing process piping, or for that matter, heat exchangers, where considerable pressure losses occur due to sudden contraction or enlargement of the flow cross section, the calculations required for determining these losses are many and laborious and there are no reliable relationships available for their rapid estimation. Such calculations are a prime requisite for the writing of pump specifications. Consequently, the nomograph presented herewith should be a valuable tool for engineers and piping designers, as it has been many times for the writers.

When there is a sudden contraction the loss in fluid head is expressed as $F = KV_1^2/2g$, where F is the loss of head in feet of the fluid flowing; V_1 is the downstream velocity in feet per sec.; g is the acceleration due to gravity in feet per $(sec)^2$; and K is a constant which is a function of the ratio R of the downstream and upstream inside diameters, D_1 and D_2, respectively. For values of R^2 less than 0.715, $K = 0.4(1.25 - R^2)$ which, from the first equation, is also equal to the number of velocity heads, N. When R^2 is greater than 0.715, $K = 0.75(1 - R^2)$ which is also equal to the number of velocity heads, N. Hence for both cases, $F = N V_1^2/2g$.

In the case of a sudden expansion, $F = (V_1 - V_2)^2/2g = V_1^2(1 - A_1/A_2)^2/2g$, where F and g are as defined above, V_1 is the upstream and V_2 the downstream velocity, both in feet per sec., and A_1 and A_2 are the upstream and downstream inside areas, respectively, in square feet. Since $R = D_1/D_2$ we may write $F = (V_1^2/2g)(1 - R^2)^2$ and $N = (1 - R^2)^2$.

The accompanying nomograph was constructed by the usual methods from these equations. To illustrate its use two typical problems are outlined on the chart by means of the lettered lines. The problems are as follows:

1. What is the loss in pressure when 500 g.p.m. of fluid flowing in 8-in. Schedule 40 i.p.s. pipe enters a 2-in. Schedule-40 i.p.s. pipe. Also:

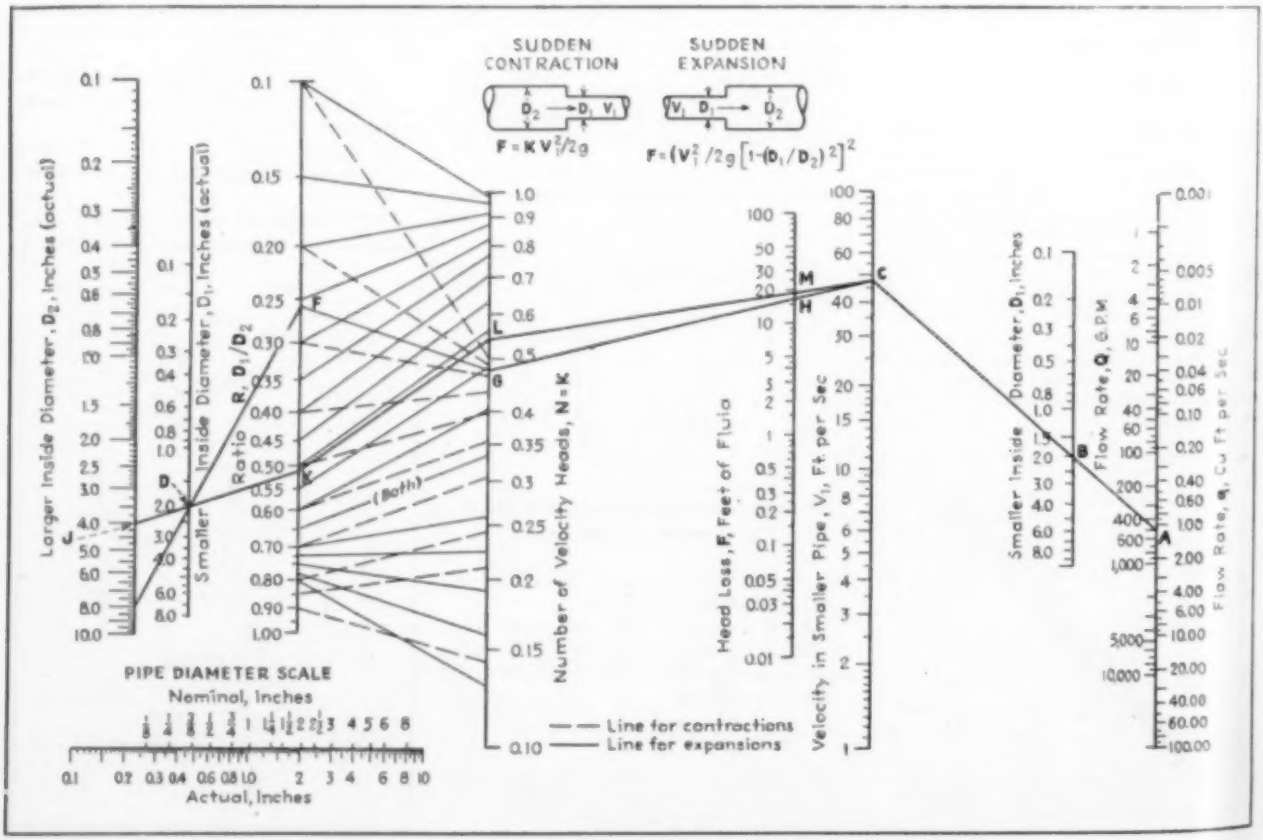
2. What is the pressure loss when the same fluid at the same flow rate enters a 4-in. i.p.s. pipe from the 2-in. pipe?

Note in the lower lefthand corner of the chart a scale giving true inside diameters of Schedule-40 pipe for various nominal sizes. For other weights of pipe, such as Schedule-80, the true inside diameters can be determined from handbooks. True inside diameters must be used in the nomograph.

The solution of Part (1) is to draw a line through Point A at 500 g.p.m. and Scale Q (Point B) at 2.067 in. on the righthand inside diameter line, D_1, extending the line to Point C on the V_1 scale at 48.0 feet per sec. velocity. Then draw a line through Point D at 2.067 in. on the lefthand diameter line, D_1, and Point E at 8.071 in. on the diameter line, D_2, extending the line to Point F on Ratio line R. Point G is located on the Velocity Head line N by using the dotted lines as guides. (Note that for contractions the dotted guide lines between Scales R and N are used, while for expansions, the solid guide lines are used.) By connecting Points G and C the line intersects the F scale at a head loss of 16.9 ft. of the fluid, the solution to Part (1) of the problem.

For Part (2) of the problem the solution is obtained similarly except that D_1 (Point J) is now 4.026 in., giving a line intersecting the R scale at Point K. The solid guide lines are now used, leading to Point L on the N scale and, through Line LC, to the solution at Point M on the F scale at 19.3 ft. of the fluid. In this case, of course, the values of Q, D_1 and the V_1 are common to both problems. With care the accuracy of use is about ±3 percent.

This nomograph determines expansion and contraction losses in pipe lines and heat exchangers


SUDDEN CONTRACTION
SUDDEN EXPANSION
F = K V₁²/2g
F = (V₁²/2g)[1-(D₁/D₂)²]²
Larger Inside Diameter, D₂, Inches (actual)
Smaller Inside Diameter, D₁, Inches (actual)
R, D₁/D₂ Ratio
Number of Velocity Heads, N = K
Head Loss, F, Feet of Fluid
Velocity in Smaller Pipe, V₁, Ft. per Sec
Smaller Inside Diameter, D₁, Inches
Flow Rate, Q, G.P.M.
Flow Rate, Q, Cu. Ft. per Sec.
(Both)
PIPE DIAMETER SCALE
Nominal, Inches
Actual, Inches
— — Line for contractions
—— Line for expansions

PROCESS EQUIPMENT NEWS

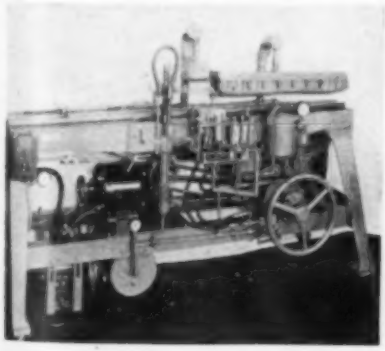
THEODORE R. OLIVE, Associate Editor

VERSATILE LABELER

QUICK adjustment to take care of labels ranging in size from a postage stamp to a postcard, for containers from a 1-oz. package to about a gallon size, is claimed for the new Vac Spray Labeler, manufactured by the Vac Spray Machine Co., 1701 Olson Memorial Highway, Minneapolis, Minn. It is claimed that this wide range of adjustability requires the purchase of no extra parts and that changes from one size to another take from three to five minutes. Speeds up to 40 labels per minute are secured. The accompanying illustration shows the machine. Containers are entered at the left on an adjustable track. As they move toward the right, the label, which has been sprayed with a light film of glue, is applied at the proper position, after which the containers pass under the sponge rubber wiper. At each forward movement of the line of containers, the wiper comes down around the container, pressing the labels firmly and eliminating the need for further wiping. One girl, it is claimed, can easily complete the entire labeling operation. The average size container receives about five pressings.

The label handling, also, is interesting. Labels are placed in a box of adjustable size, quickly changed to fit the label by two small hand cranks. Labels are picked up by a vacuum picker and as they are transferred to the container they pass over a spray aperture where the adjustable spray is said to assure the finest possible coating of adhesive, reducing the amount of glue needed to an average of only 1 pint per full day's operation. Practically any type of label or glass container can be processed successfully and it is claimed the labels are always in uniform position and always clean and straight.

New vacuum spray labeler



Fluid impactor for liquids and pastes

PULSATION DAMPER

TO PERMIT the averaging of pressure pulsations for the measurement of pressure and flow, Taylor Instrument Cos., Rochester 1, N. Y., has announced a new pulsation damper for use where pulsation amplitudes exceed 1 percent of full scale range. Ordinarily devices of this type employ either a variable or a fixed orifice. Such devices present inherent difficulties such as easy plugging or distortion of the true reading. The new Taylor damper consists of a tube containing a series of alternate small capacities (volumes) separated by orifices. To overcome plugging difficulties a fine mesh screen is provided at both entrance and exit of the damping unit and in addition a rod passes axially through the series of orifices and can readily be removed, thus exposing a large orifice area for simple and effective cleaning. The unit is suitable for working pressures to 1,500 lb. per sq. in. and is adaptable to either liquid or gas service. In operation the various capacities "breathe" with decreasing intensity as the waves of pulsation pass through the damping unit, until finally a point is reached where the pressure level lies at substantially the average value.

IMPACT HOMOGENIZER

COMPLETING several years of development, the Asbury Corp., 127 So. Main St., Doylestown, Pa., has announced the Asbury Fluid Impactor, a new device for disintegrating, dispersing, homogenizing and emulsifying solids and liquids, and pastes. Somewhat resembling a colloid mill, the Impactor differs in principle in that, instead of operating on the basis of fluid shear, it employs a specially designed rotor to produce impact upon a liquid by means of centrifugal force. Design features include a novel liquid seal which it is claimed should outlast the life of the bearings, and the use of a circulating oil pump with sight gravity feed. The mill operates at speeds ranging from 3,600 to 15,000 r.p.m., the speed being the only adjustment, which is variable to meet individual requirements and is readily altered by changing the motor drive pulley and belt. Since there is no frictional contact, it is claimed that dimensional changes due to high or low operating temperatures have no effect on the operation of the mill. The discharge outlet, completely immersed in a water jacket, is claimed to have a condenser action. The mill is recommended by the maker for the processing of paints, enamels, sizing compositions, inks, latex, sulfa compounds and food products, as well as for the dispersion of solids.

Automatic bag dumper

BAG DUMPER

FOR THE LIFTING and emptying of heavy bags up to 300 lb., only a ½ hp. motor is required in the Ritchie bag dumper manufactured by the Asco Mfg. Co., 601 South Anderson St., Los Angeles 23, Calif. As shown in the accompanying illustration, the device consists of a chute on which the bag is placed, open end up. A hoisting mechanism pivots the chute near the top of the apparatus, discharging its content through the funnel shown at the top to direct the bag's contents into a vat or machine without spilling. Two spikes catch and hold the bag while dumping. The chute will handle a bag 24 in. wide.

Special features include an automatic shut-off switch which stops the motor at the top and bottom positions of the lift. As an added safety feature, a special clutch arrangement disengages the motor if the downward return of the chute is obstructed. Upward lift takes ten seconds, with eight seconds to lower.

NOVEL CHECK VALVE

PERMATITE is the name given to a new type of check valve recently announced by the Harman Equipment Co., 937 Santa Fe Ave., Los Angeles, Calif. The valve has no metal working parts. Instead, back-flow is checked by a neoprene synthetic rubber tube which easily opens for either vacuum or pressure, permitting direct flow, but closes when the flow is stopped. The opening and closing movements are said to be

such as to prevent foreign matter from fouling the valve and causing leakage. It is claimed that laboratory tests for periods exceeding 24 hours have shown that the valve, immersed in water, will hold a 28-in. vacuum and that the valve acts as a check against back-flow under a static head of 29 in. without showing any evidence of leakage. The valve is said to be adapted to use with air, natural gas or many commercial liquids including all petroleum products, hot or cold water and any chemical that will not attack synthetic rubber. Available sizes, for 125 lb. per sq. in. working pressure, include ½, ¾ and 1 in. sizes, with other standard sizes to order.

PENICILLIN DRYER

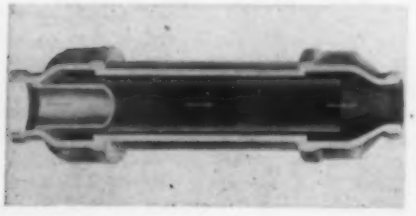
DEVELOPED by Radio Corp. of America, a new all-electronic drying system for penicillin is being manufactured and sold by the F. J. Stokes Machine Co., Olney P. O., Philadelphia, Pa. A single installation of the new system can, it is claimed, produce ready-to-use vials of penicillin at the rate of 2,000 per hour, each vial containing 100,000 Oxford units. It is claimed that this operating rate exceeds that of conventional equipment requiring four times the floor space and involving three times the investment. The entire system can be installed in a room 10x20 ft., leaving ample space for loading and unloading operations. The system includes three separate units: (1) A bulk reducer employing electronic heat, which completes in 30 minutes a bulk dehydrating operation requiring 24 hours by existing methods; (2) a vacuum dryer employing electronic heat which in three minutes reduces 1 c.c. quantities of concentrated penicillin solution to a dry film in vials; (3) vacuum heating chambers which remove the last traces of moisture from the dried product.

The accompanying view shows these three stages in the operation, from left to right. The glass-bulb bulk reducer at the left evaporates at the rate of 3 liters per hour, employing a 2,000-watt radio-frequency generator and an evaporation temperature of 50 deg. F. The six-unit vacuum dryer at the center of the view heats the vials electronically while they are rotated individually at 3,000 r.p.m. In the last step the vials are heated electrically in a moderate vacuum for 30 minutes, employing two units.

RECIRCULATING OVEN

FOR BAKING and drying operations requiring the quick removal of volatile materials, a shelf-loading oven or dryer with a self-contained heating system has been developed by Gehnrich Oven Division of W. S. Rockwell Co., 50 Church St., New York 7, N. Y. The unit is of insulated steel panel construction, the thickness of insulation depending on the temperature of the process. Firing into a combustion chamber at the left of the unit is a line type gas burner connected to a gas-air proportioning unit of the motor-operated type. Standard equipment includes protective and re-lighting devices. Heat generated by the burner is drawn upward by means of a large recirculating fan mounted on the roof, which forces the heated air through a duct into a distributor at the right side whence the air is forced through adjustable side louvers in streams across the full width of the casing. Mounted also on the roof is a motor-driven exhaust fan which determines the amount of circulating air that is discarded. Any temperature between 100 and 1,000 deg. F. can be employed.

Phantom view of new check valve

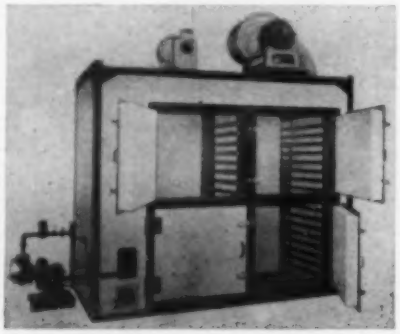


METALLIZING GUN

DESIGNATED as Model F, a new Mogul metallizing gun has been announced by the Metallizing Co. of America, 1330 West Congress St., Chicago 7, Ill. The new gun is lighter in weight, better balanced and smoother in operation than previous models. Provision has been made to protect the working parts of the gun against dirt and foreign matter which might otherwise get into the turbine housing when the gun is not in operation. The number of parts has been minimized and the gun can be assembled or disassembled without the use of special tools. Maximum spraying speeds are claimed for all types of metal, from the hardest to the softest. A finger-tip speed control is provided to change spraying speeds. Reported capacities include 14 lb. per hour of steel, 40 lb. per hour of zinc and as much as 120 lb. per hour of lead. Low gas consumption also is claimed.

Electronic penicillin drying installation

Recirculating cabinet-type dryer or oven



V-BELT SHEAVE

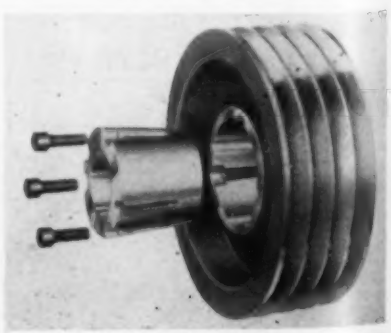
QUICK mounting and demounting are claimed for a new line of Taperlock V-belt sheaves recently announced by the Dodge Mfg. Corp., Mishawaka, Ind. To install it is only necessary to slip the sheave and bushing assembly on to the shaft and tighten two or three locking screws, depending on the size of the sheave. As shown in the accompanying illustration, the bushing is split and the screws exert a pushing action against the unthreaded bushing, forcing it into the tapered bored hub. Thus the bushing contracts and wedges between the hub and shaft on which it is installed. To demount, the locking screws are removed and one or two of them are inserted in screw jack holes which are partially in the bushing and partially in the hub. As the screws are tightened, the bushing is de-wedged from the unthreaded hub and the sheave is free for removal.

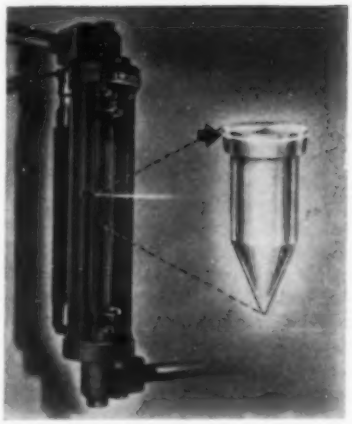
IMPROVED MANOMETERS

TWO NEW series of manometers for use with its liquid level gages have been announced by King Engineering Corp., Ann Arbor, Mich. There are four different lengths of scale in each series, the scale length in inches being used as the designation of the instrument. These lengths are 12, 20, 28 and 35 in. Instruments designated as Model TR employ a red manometer liquid of 2.94 specific gravity, while instruments designated as Model TM use mercury which has a specific gravity of 13.56. Thus, when used to measure the depth of liquid of specific gravity 1, the TR series covers a range of maximum height measurements from 38 in.

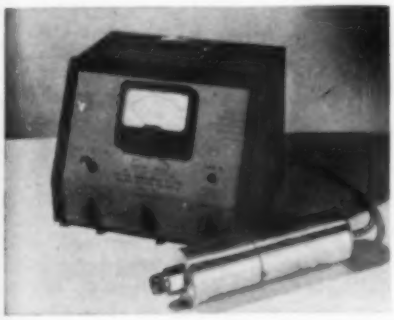
Improved metallizing gun

Taperlock V-belt sleeve





Line-o-Light rotameter illuminator



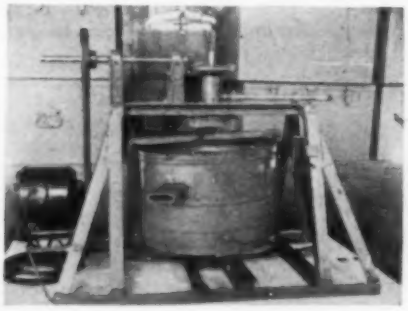
New all metal ionization gage

for Model TR-12 to 9 ft. 2 in. for Model TR-35; while the comparable range for the mercurial type is 14 ft. 3 in. for Model TM-12 and 41 ft. 5 in. for Model TM-35. Proportionately greater heights may be measured when the tank content is of lower specific gravity. These manometers are employed with the pneumatic system of level measurement, measuring the pressure of air in a dip pipe installed in the tank, either with or without a pressure equalizing connection. The new manometers are rigidly constructed in steel cases which are rustproof and given a suitable finish. The stainless steel front cover rim holds the glass window securely in place, protecting the tube and scale from dirt or damage. An air pump is built into the bottom of the instrument case.

METAL IONIZATION GAGE

CONTINUOUS linear response to 10 mm. total pressure is claimed for the Alphatron all-metal ionization gage recently announced by the Vacuum Engineering Division of National Research Corp., Boston 15, Mass. The ionizing agent is a stream of alpha particles emitted by a radioactive source, which permits opertion at any pressure, including atmospheric, without danger to the gage. The steady emission characteristic of the radioactive element, and advanced amplifier design, are said to assure great stability and reduce needle flicker to a minimum. Three ranges are presently produced: 0 to 0.1 mm., 0 to 1 mm.; and 0 to 10 mm. Pressures can be read to 1 percent of the full-scale reading in each case. Since the linear response holds true regardless of the type of gas being measured, the new gage is said to be particularly suitable for measuring pressures of gases other than air, such as argon, water vapor and hydrogen.

Moisture meter for curved surfaces



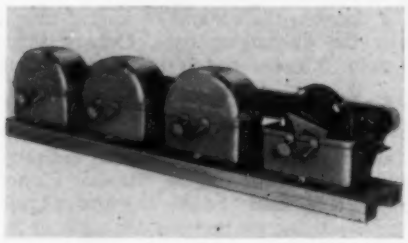
M-12 portable Gyro Concentrator

ILLUMINATED ROTAMETER

TO FACILITATE flow measurements in opaque liquids, Schutte & Koerting Co., Philadelphia, Pa., has introduced the Line-o-Light rotameter rotor, which has the same basic design as a standard SK rotor, but has a disk of transparent material sandwiched into the rotor head which materially reduces the distance the light must travel through the opaque liquid from its source behind the tube. This feature is shown clearly in the accompanying illustration. The new rotor can be used in practically any application and in any type of tapered glass-tube rotameter. Two types of light transmitting disks can be furnished: Lucite for general applications, Pyrex glass for extremely hot or highly corrosive liquids.

MOISTURE METER

A NEW type moisture meter of the electrical type, designated as Model K-2, has been developed by the Moisture Register Co., 133 North Garfield Ave., Alhambra, Calif. The special feature of the new meter is a new type of electrode equipped with buttons individually spring-cushioned to allow every button to maintain contact regardless of the contour of the material being tested. Thus the moisture content of such materials as paper in either stacks or rolls of varying diameter, as well as other materials having curves or irregular surfaces, can be measured. In common with other Moisture Registers built by this company, this instrument operates on the principle of power absorption from a high frequency oscillator circuit. It is claimed that the instrument is able to determine low moisture percentages, actually providing readings down to zero percent.



Multi-compartment reagent feeder

Accurate moisture checks can be made with the new model by anyone in three seconds or less, according to the manufacturer. The instrument is portable, weighing only 5 lb.

MINERAL CONCENTRATOR

WHAT APPEARS to be a new principle in mechanical concentrating equipment for minerals, operating on the basis of specific gravity differences, is a device developed by A. A. Johnston, 705 S. E. Belmont St., Portland, Ore. This device, known as the Gyro Concentrator, duplicates closely, but by precise mechanical means, the concentrating motions used in the hand panning of gold. The machine consists of a gyrating mechanism supporting a superimposed series of three concentrating pans above which is a classifying screen. The pans may be operated either in series or in parallel, and either batchwise or continuously. Adjustment of the gyrating mechanism permits variation both of the eccentric throw and of the angle that the axis about which gyration occurs makes with the vertical. A depression in each of the concentrating pans is provided at a point of maximum quiescence of the motion to collect the heavier material (valuable material) but it is possible to collect the lighter material by suitable adjustment. The device employs water as the concentrating medium. The M-36 size, requiring 1 hp., is stated to have a capacity of 7 cu. yd. of ¼-in. feed material per hour, requiring 72 g.p.m. of water; the M-25 portable size, requiring ½ hp., is said to have a capacity of 3 cu. yd. per hour of ½ in. feed material and to require 20 to 30 g.p.m. of water.

So far, it is understood the machine has been employed only in the concentration of gold ores, but it is believed by the designer to be suitable for other mineral concentrations, possibly of such ores as chrome ore, magnetite, zircon and cassiderite.

REAGENT FEEDER

SINCE many chemical and flotation processes require the distribution of several chemicals or flotation reagents simultaneously and in different quantities to different points in the circuit, Denver Equipment Co., P. O. Box 5268, Denver 17, Colo., has developed a multi-compartment feeder that is available in various combinations from one to six compartments. Each compartment is identical in construction with the others but can be varied independently. Feeder cups are bolted to a plate steel disk. The size and number of cups used can be changed while by means of a micrometer screw adjustment the drip trough can be moved in or out to increase

or decrease the amount of reagent caught by the discharging cups. Only a single motor is necessary for the complete unit.

KARBATE COUPLINGS

FOUR new Karbate pipe connections for use in the chemical and process industries have been perfected by National Carbon Co., Cleveland, Ohio. These chemically resistant-pipe connections are made of impervious graphite or carbon and are said to possess good mechanical strength in addition to high thermal shock and corrosion resistance. One type, designated as FC, is a flexible coupling particularly intended for field installations or other applications where an average amount of pipe movement is encountered. No cement is required in jointing the lengths of pipe. The Type V flanged connection offers the advantages of the Van Stone joint, employing thick small-diameter collars on the pipes, together with companion flanges of almost any design or material. Type V nozzles and Type SC slotted couplers now available are usually factory installed on tanks, towers, heat exchangers and similar equipment.

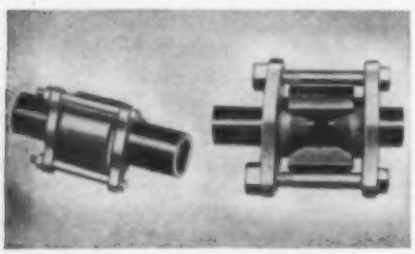
PIPE CLEANING TOOL

A SELF-CONTAINED power-driven tool for cutting and removing obstructions, stoppages, slush or scale from curved or fitted pipes, drains, tubing, sewer lines, etc., is announced by Spartan Tool Co., 6007 North Lincoln Ave., Chicago 45, Ill. As shown, the machine is designed to house and drive up to 100 ft. of $\frac{1}{4}$ in. flexible steel shafting. The flexible rod automatically coils and uncoils as it is fed into and from the container. The driving mechanism is a motor-driven head which is removable from the stand. In operation, this driving unit is held at the opening of the pipe or tube so that the desired length of flexible rod is fed into the pipe. For cutting scale and similar applications, the flexible rod is equipped with a spring-steel cutter head operating normally at 300 r.p.m. It is claimed that the device operates satisfactorily regardless of the number of 90 deg. elbows or T's in the line. Should the head encounter resistance from an obstruction, the effect of the flexible shaft is to store up energy until the accumulated torque overcomes the resistance and the release of such torque load spins the cutter at speeds of approximately 750 r.p.m.

OBSERVATION DOOR

DESIGNED for use in boilers, oil stills, and other industrial furnaces, a new observation door available at low price has been announced by Bigelow-Liptak Corp., 2842 West Grand Blvd., Detroit 2, Mich. This door consists of a substantial cast iron frame carrying two shutters, one solid and ribbed with cooling fins on its outer surface, the other for observation, provided with three parallel pieces of extra-thick heat-resisting blue glass, air-cooled on both sides. When the interior of the furnace is to be observed, the solid shutter is opened by pulling a chain, after which the interior can be observed through the lens, or the lens frame can be swung into open position for direct observation. A space of several inches is provided between the shutter and the lens frame to permit a film of cooling air to pass between the two, thereby minimizing the risk of damage to the glass from radiant heat.

Type FC flexible Karbate coupling



CONTINUOUS CENTRIFUGAL

DEWATERING of non-abrasive materials through centrifugal force is the function of a new continuous centrifugal recently announced by Denver Equipment Co., Denver 17, Calif. This centrifugal is of the type employing a revolving perforated basket within which is a scraper to discharge the solids collected on the basket. Both basket and scraper rotate in the same direction, with a small differential in speed, and are inclosed in a housing. For cases where a thin layer of solids should remain on the basket screen to form a filter medium, an adjustment is provided for the clearance between the basket and the scraper. This clearance is adjustable from $\frac{1}{32}$ to $\frac{1}{8}$ in. In operation, feed enters a hopper at one end and is picked up by a screw conveyor for transfer into the rotating basket. Filtrate passes through the screen and is collected by the housing, while the solids are conveyed to the discharge end by the slower rotating scrapers.

LOAD-COMFORMING HOIST

FOR CERTAIN types of hoist drive for traveling cranes, especially for those handling a wide range of loads where handling speed and safety are important, the Industrial Engineering Division of General Electric Co., Schenectady, N. Y., has developed the new Maxspeed drive system. This device automatically "measures" the load so that it is hoisted and lowered at the maximum safe speed for that particular weight of load, yet prevents the handling of the dangerous overloads. The drive operates from either a.c. or d. c. power. In either case a d.c. hoist motor of somewhat conventional type is used, powered by a generator and a novel cross-flux exciter. If the incoming power is d.c., a shunt-wound d.c. motor drives the generator and exciter. If the incoming power is a.c., an induction motor is the driving source. Additionally, an ordinary constant-voltage exciter is required for a.c. units. The special construction of the cross-flux exciter and the way it is connected to the other components of the drive produce the unusual characteristics.

In operation, heavy loads are both hoisted and lowered at slow speeds, and light loads at higher speeds. Intermediate loads are handled at intermediate speeds, depending on the load weight. The speed changes are inherent in the drive and do not depend on the functioning of control devices. All braking is accomplished electrically, with the power returned to the supply system instead of being dissipated in resistors. A solenoid brake holds the load when at rest.

Portable cleaning tool for pipes

PIPE MARKERS

FOR THE PURPOSE of coding industrial piping as well as conduits and cables, the Western Lithograph Co., 600 East 2nd St., Los Angeles 54, Calif., has developed a standard coding system consisting of readily identifiable markers produced in strips of tough, durable material, which stick readily to the material being identified and require no moistening. Dispensing and attaching tools are unnecessary. In addition to the identifying marking, the markers carry an identification in words printed in clear black lettering.

FOAM EXTINGUISHER

CLAIMED to produce 50 percent more foam than any other foam type extinguisher of the same capacity, a new 40 gal. engine known as the Foamite Challenger has been introduced by American-La France-Foamite Corp., Elmira, N. Y. In less than three minutes the engine is said to deliver 450 gal. Among the several new features is a metering device, which is the important factor in foam-making. It is claimed that the foam delivered is tougher, more tenacious, and more lasting than that previously available, and that it extinguishes hot oil fires without the danger of reflash.

40-gal. foam extinguisher

Experience

irdler offers a thoroughly competent engineering service in processes for gas manufacture, rification, separation, and dehydration. The men of the Gas Processes Division are experts in eir field, qualified by wide, first-hand experience to provide the most efficient, profitable solu-on to your processing problem whatever it may concern—hydrogen sulphide, carbon onoxide, carbon dioxide, natural gas, refinery gases, liquid hydrocarbons, hydrogen, nitrogen. s originators of the Girbotol Process they have no superior in the development of improved s processing techniques to meet the needs of the times.

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1 Searles Lake from which the plant of American Potash & Chemical Corp. (in foreground) gets its raw material. Note community of Trona and Slate Range

A Chem & Met PICTURED FLOWSHEET

SEARLES LAKE CHEMICALS

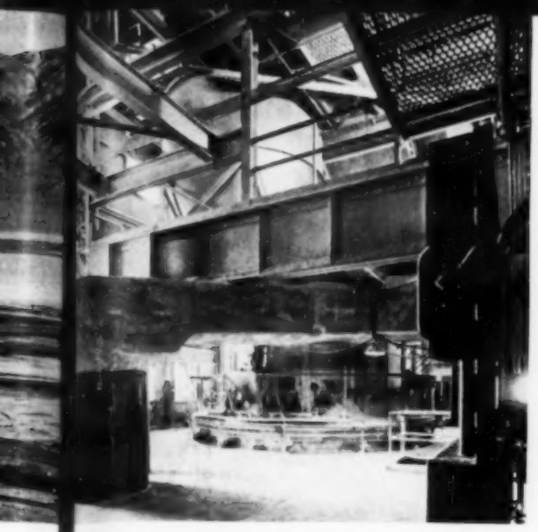
THE TRONA, Calif. plant of American Potash & Chemical Corp. operates on brine from the porous salt body of Searles Lake. Brine is pumped from wells and concentrated in triple-effect evaporators, with cycled mother liquors. During evaporation, sodium chloride and burkeite (sodium carbonate-sodium sulphate double salt), with a small amount of lithium-sodium phosphate, separate from the liquor and are classified. The fines, mainly burkeite and entrained lithium values, are sent to the burkeite digestion process and leached free of sodium chloride. The filtered burkeite is dissolved in water, while lithium-sodium phosphate remains in suspension and is removed by froth flotation.

Clarified burkeite liquor is sent to the sulphate process and cooled to crystallize sodium sulphate as glauber salt. The latter, converted to anhydrous sodium sulphate, is marketed as salt cake or desiccated sodium sulphate, depending on specifications. Glauber salt filtrate is treated in the carbonate process where residual sulphate content is reduced by dissolving sodium chloride to precipitate burkeite. The resulting liquor is cooled to separate sodium chloride, then sal soda. The latter is recrystallized as sodium carbonate monohydrate, which is calcined to finished soda ash.

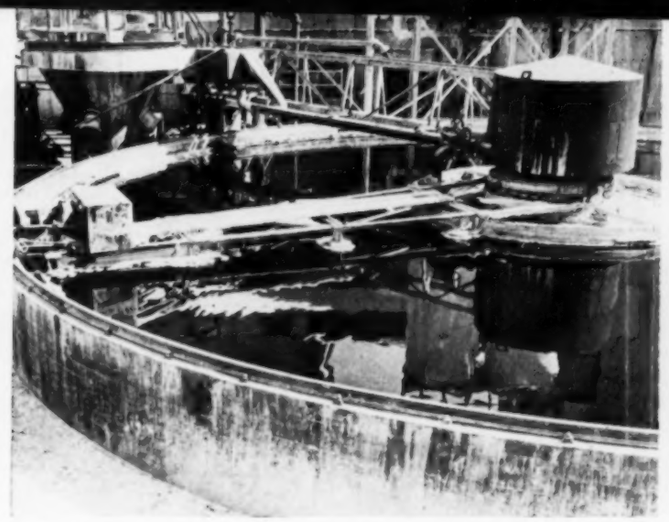
Hot concentrated liquor from the main evaporators is cooled rapidly to crystallize KCl, which is separated as agricultural grade. Part of the KCl is reacted with burkeite to produce K_2SO_4; another portion is recrystallized to produce chemical grade KCl. During refining, the KCl solution is treated (in Kubierschky-type towers) to remove bromine, which is refined and marketed as liquid bromine or as alkali bromides of U.S.P. quality.

Mother liquor from the primary KCl crystallization is further cooled to crystallize crude borax, and returned to the evaporators, completing the main cycle. Crude borax is leached with brine to remove impurities and recrystallized for marketing as refined borax. Part of this is dehydrated by fusion, producing Pyrobor, a crystalline anhydrous borax (patented); part is treated with sulphuric acid, producing technical and U.S.P. grades of boric acid.

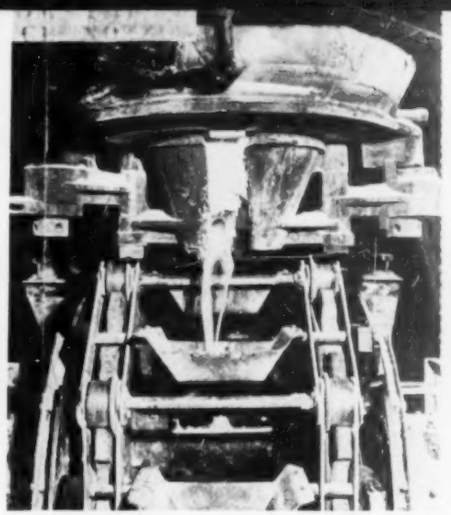
CHEMICAL & METALLURGICAL ENGINEERING
October, 1945
PAGES 134 to 137



Furnace where calcined borax is fused; an ration in producing anhydrous borax

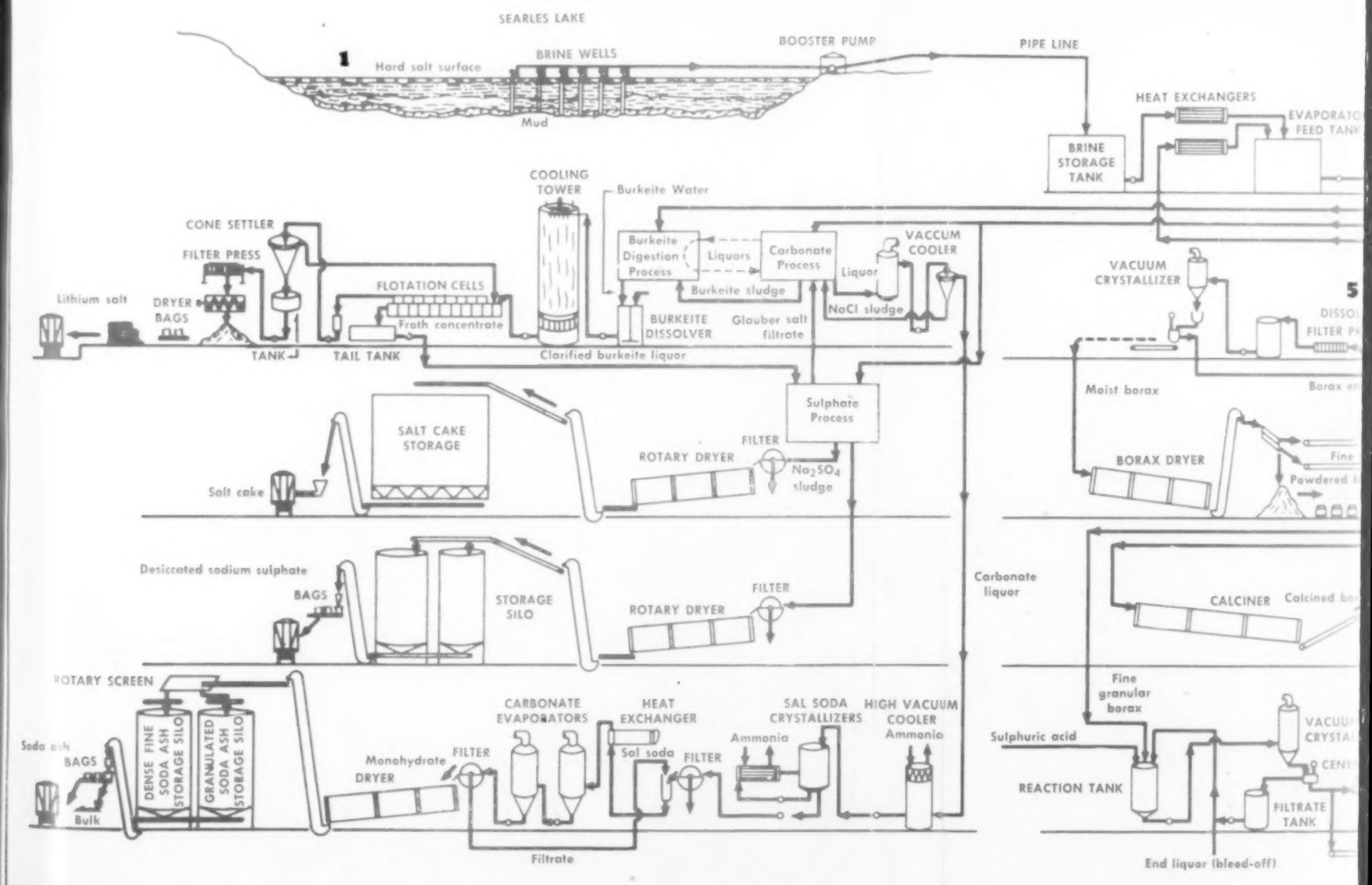


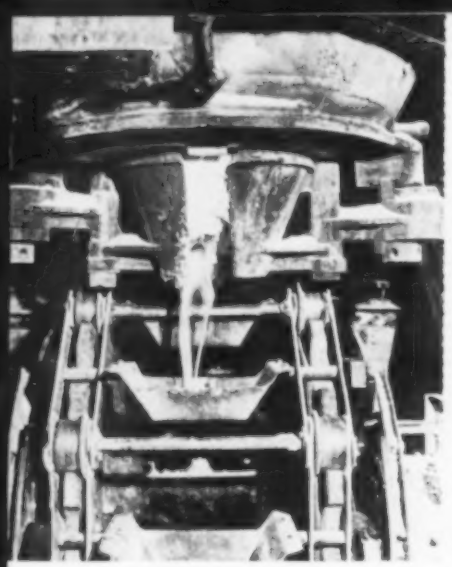
3 This is one of a series of Dorr thickeners in use at the Trona plant. This one is used in the borax recovery system



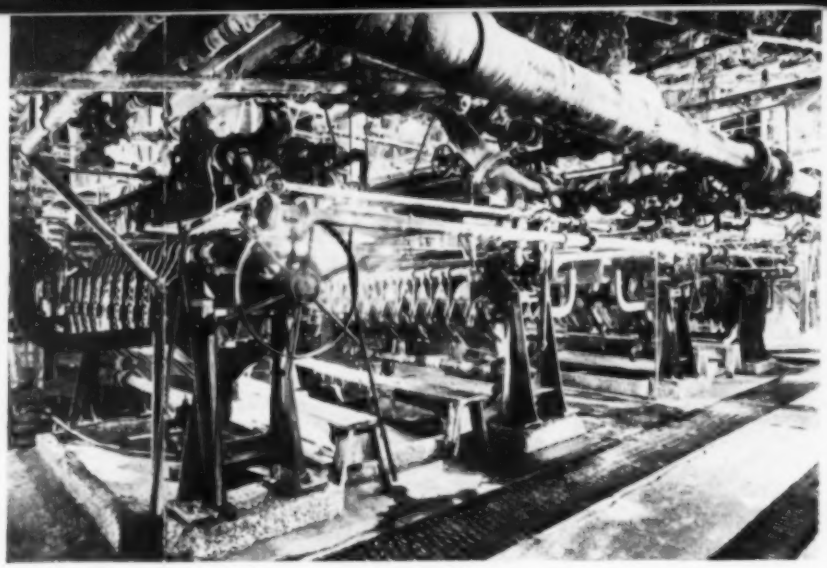
4 Molten dehydrated borax flowing from furnace in the anhydrous borax plant

5 Batter removed

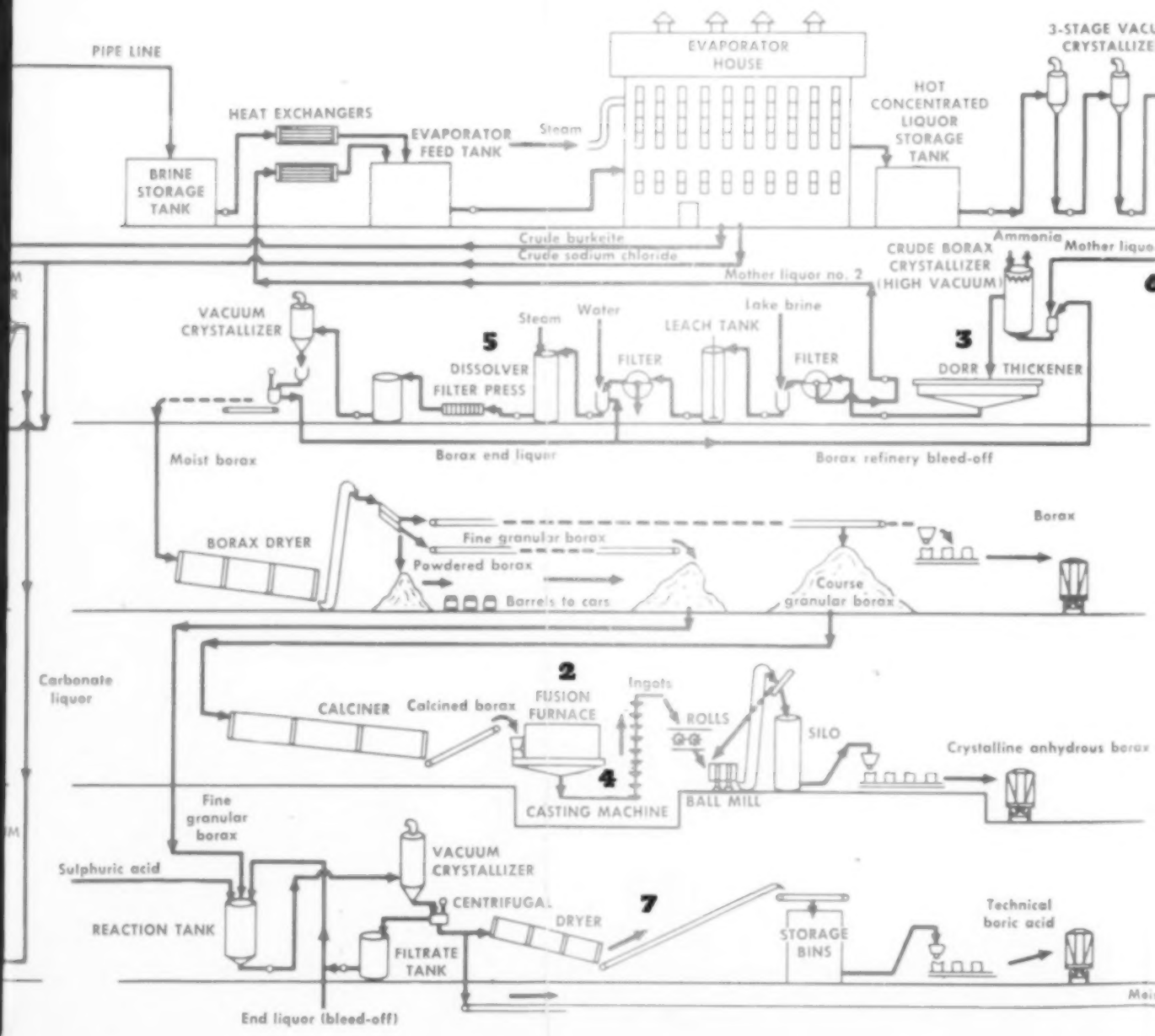


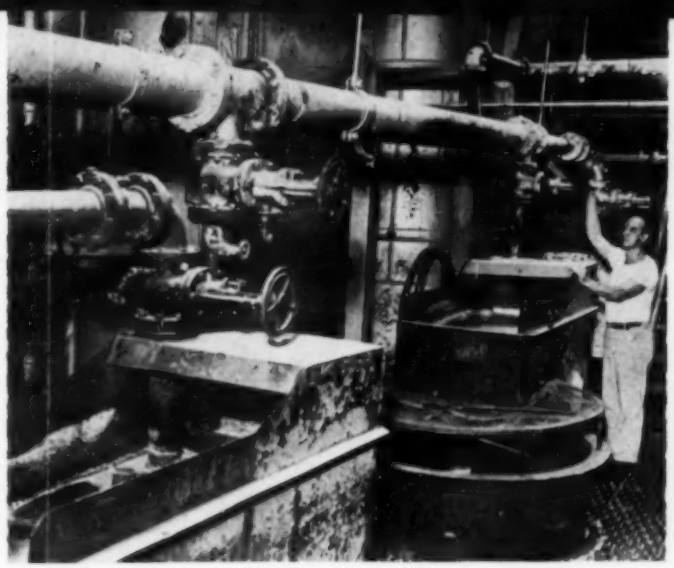


Molten dehydrated borax flowing from nace in the anhydrous borax plant

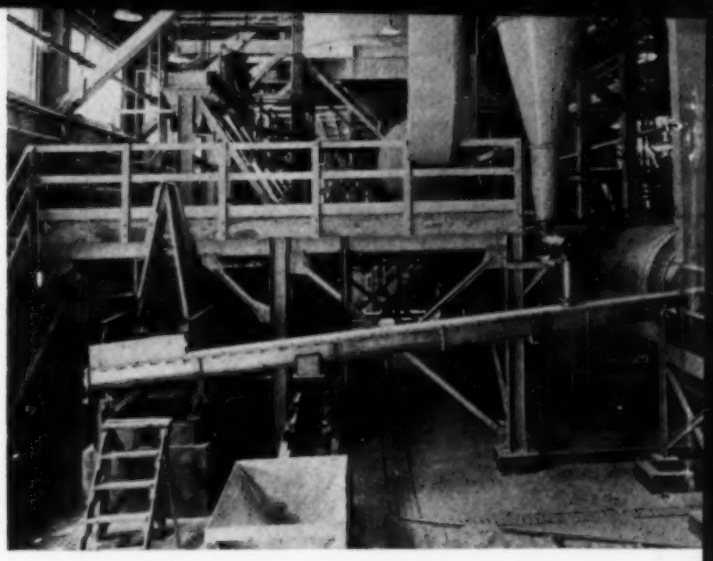


5 Battery of filter presses utilized in borax plant. All impurities are removed from crude borax in several operations before crystallization

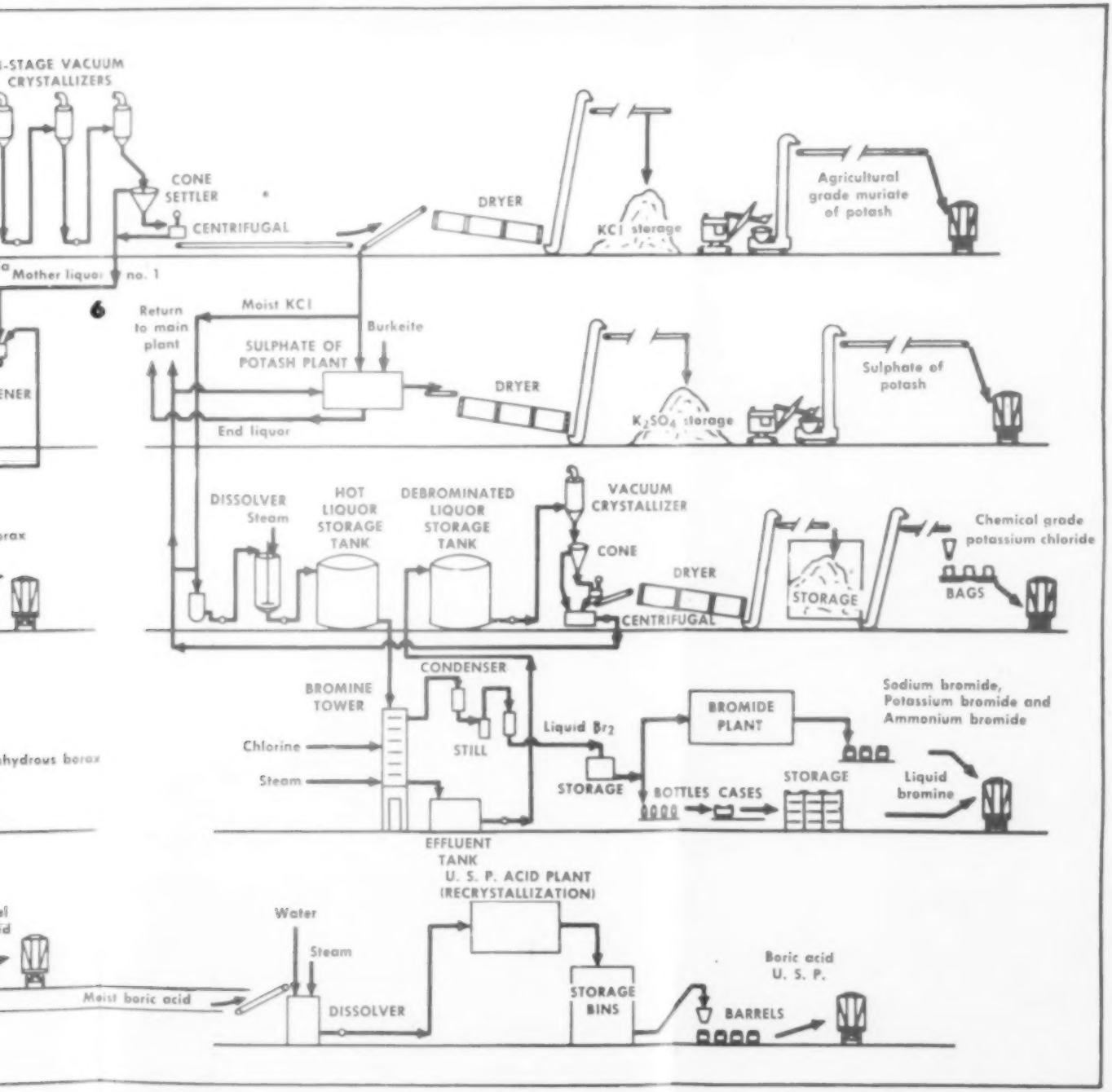




6 Through the weirs in foreground mother liquor No. 1 is entering the borax plant for the recovery of this material



7 Fine granular borax becomes the raw material from which technical boric acid is produced



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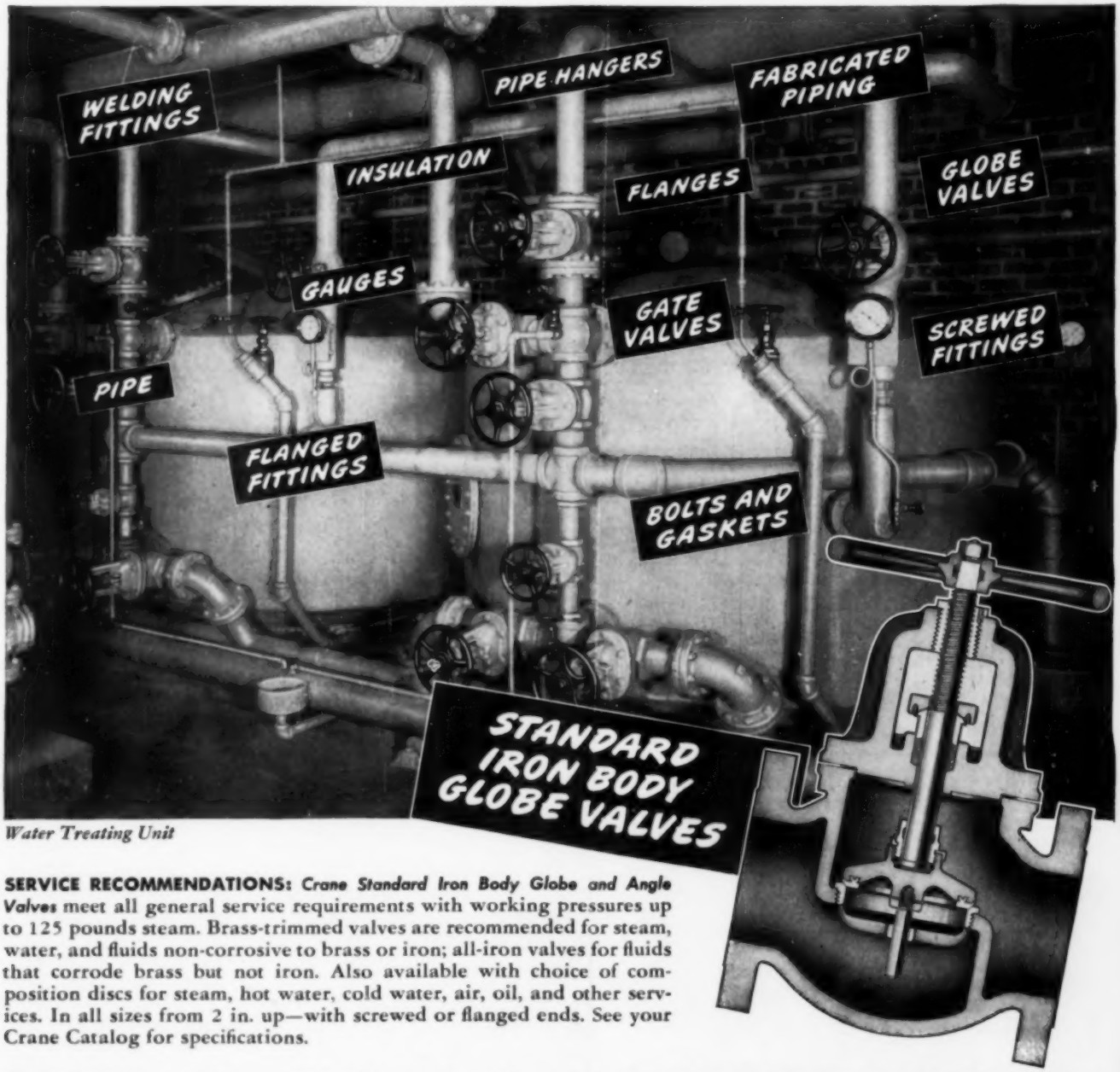

Water Treating Unit

SERVICE RECOMMENDATIONS: ***Crane Standard Iron Body Globe and Angle Valves*** meet all general service requirements with working pressures up to 125 pounds steam. Brass-trimmed valves are recommended for steam, water, and fluids non-corrosive to brass or iron; all-iron valves for fluids that corrode brass but not iron. Also available with choice of composition discs for steam, hot water, cold water, air, oil, and other services. In all sizes from 2 in. up—with screwed or flanged ends. See your Crane Catalog for specifications.

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NEW PRODUCTS AND MATERIALS

R. W. PORTER, Assistant Editor

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FLAME RESISTANT PLASTIC

A NEW flame resistant impression molding resin, designated as Thalid XR540, has been announced by the plastics division of Monsanto Chemical Co., St. Louis, Mo. This material, now commercially available, was originally developed as the plastic component of the light-weight armor worn by combat troops and ship crews for protection against injury by shell and bomb fragments, and is the first commercially available impression molding resin that provides plastic-glass cloth laminates which are self-extinguishing and do not support combustion.

Impression molding resins have greatly increased the utility of plastic materials since they require little or no pressure for fabrication and may be used in conjunction with paper, cotton or glass cloth, or with other relatively inexpensive sheet materials. These combinations provide a high degree of structural strength and permit the manufacture of a wide variety of articles. Some of the uses of impression moldings are large aircraft components, boats, large toys, furniture, instrument and machine housings, shipping crates and boxes, wall panels and bodies for trailers and trucks. Since the rate of burning in these applications is of critical importance, this new flame resistant material greatly extends the field of usefulness.

This new resin is handled in the same manner as other impressive molding resins. The filler of cloth, paper or other sheets is saturated with liquid resin, after which it is draped on inexpensive molds or forms. Application of heat then transforms the combination into a hard, tough structure of extremely light weight and high strength. Only sufficient pressure is necessary during this operation to hold the material in place.

PLASTIC FILM

PRIMARILY for use in the fabrication of pocketbooks, purses and handbags, a new vinyl film with the brand name of Glam, has been developed by the Pantasote Leather Co., Passaic, N. J. This new material is both soft and pliable and has a good resistance to abrasion and wear. It is said to be resistant to alcohol and most chemicals, and to be almost impervious to cigarette burns. Glam is produced in a wide variety of colors and will retain its original luster if cleaned by simply washing with mild soap and water. This material will be available in commercial quantities within a few months.

FLYING ICE BOX

A SPECIALLY insulated cargo container for perishable goods has been built for the United Air Lines by the J. L. Stuart Mfg. Co. of San Francisco from vinyl coated Fiberglas cloth and lightweight Fiberglas thermal insulation. Weighing 25 lbs. and with a capacity of approximately 120 cu. ft. this container is equipped with five pockets to accommodate slabs of dry ice. Constructed to fit into large cargo pits, the container walls are approximately 1 in. thick. It is loaded and unloaded by means of a zippered V-shaped opening on one side.

Various tests have been made on this container on normal airline runs which indicate that it may be useful in shipping seafoods, medicinal serums, perishable fruits and vegetables, flowers, etc.

SOIL FUMIGANT

CONTROL of soil infestations such as nematodes, wire worms, and other similar parasites which often infest such valuable agricultural products as potatoes, cotton, tomatoes, lettuce, sugar beets and pineapples, has been a crying need for centuries in all parts of the world. A new soil fumigant under the registered trade mark of "D-D" is said to have demonstrated its effectiveness against these soil infestations and has improved both quality and yields of a number of argicultural food products.

Manufactured by the Shell Chemical Div. at Houston, Tex., it is a byproduct in the manufacture of allyl chloride from propylene gas. D-D is a liquid weighing about 10 lb. per gal. and it is applied for certain nematodes at the rate of from about 200 to 400 lb. per acre. The fumigant is injected into the soil with a mechanical applicator which consists of a tank mounted on a trailer carrying a tool bar and pointed cultivator shanks. Just in back of the cultivator shank a tube carries the D-D to an underground outlet. Through these tubes, the liquid flows out under pressure in a continuous stream at a depth of 7 to 8 in. in channels 12 to 18 in. apart. A drag follows the applicator covering the channels and leaving the field smooth. One of the important advantages to be gained by this treatment is that certain crops which formerly could not be planted on the same ground in successive years due to the concentration of soil parasites can now be grown year after year without danger of crop losses. Certain experiments indicate that D-D may also affect parasite soil-borne fungi.

SILICONE VARNISH

A HEAT stable, waterproof varnish for impregnating electrical equipment has been announced by the Dow Corning Corp., Midland, Mich. Identified as DC 996 Silicone varnish which cures at the comparatively low temperature of 300 deg. F., this new coating is said to provide greater protection against failure due to sustained overloads; greatly increased service life of electrical insulation; higher permissible operating and ambient temperatures; increased protection against exces-

Perishable goods have been successfully transported by United Air Lines using this light weight, Fiberglas insulated container cooled by dry ice

Each of the 20 tablets contains 500 units of calcium penicillin

sive moisture; the elimination of fire hazards resulting from failure of convential electrical insulation, and increased power output per unit weight.

Electrical equipment wound with silicone insulating materials and sealed by impregnating with DC 996 is said to have the high order of thermal stability and the retention of waterproofness characteristic of silicone insulation. Electrical equipment treated with this new silicone varnish may be baked fully assembled without damaging the commutators or slip rings and the temperature required to cure this material does not affect shellac-bonded mica or core plating. DC 996 is now commercially available according to the manufacturer. The electrical properties and specifications of this material are given in the accompanying table.

Electrical Properties

Dielectric strength, volts per mil	1,500 to 2,000
Dielectric constant at 1,000 cycles	3.0
Power factor at 1,000 cycles, percent	0.7

Specifications

Solids Content (dried 3 hr. at 135 deg. C) percent by wt.	60
Density at 25 deg. C.	1.05
Weight lb. per gal.	8.75
Viscosity at 25 deg. C., poises	2–5
Drying time to tack-free condition at 150 deg. C., hr.	1–4

RUST DISINTEGRATOR

DEVELOPED by Service Industries, Philadelphia, Pa. for cleaning metal tanks prior to application of acidproof coatings, Ferox a non-flammable rust removing solution, eliminates the need for sandblasting in such work. A chemical rust disintegrator, Ferox is said to remove completely all rust and at the same time fortify the metal against further corrosion from atmospheric moisture. Because of its penetrating power, it attacks rust in all pores, seams, holes, joints and interstices removing the rust without harm to the metal. It will also remove lime and cement from metal.

Ferox may be used for cleaning rust spots from various fabrics including rayon, nylon, linen, muslin, wool, etc., also from porcelain enamel and plated surfaces. This material may be applied with a paint brush, or spray gun but in certain operations tank dipping is most economical. Ferox may be used either hot or cold, removing rust in one to three hours at room temperature and 5 to 20 min. at 160 deg. F. Since it creates a chemical bond coat that is an integral part of the metal, it makes an ideal prime coat prior to the application of paint, enamel, lacquer and various coatings.

PENICILLIN TABLETS

HERETOFORE administered by injection only, penicillin can now be taken orally in the form of tablets. Developed by the Cutter Laboratories, Berkeley, Calif., Pen-Troches are being made available in drug stores throughout the country. Each of the 20 round lozenges in a vial contains 500 units of calcium penicillin. One of the principal uses of the Pen-Troches is the cure of trench mouth or Vincent's angina, but it is expected that they will be valuable in the treatment of other mouth and throat infections. While available for immediate consumption the Pen-Troches will be sold on a prescription basis only, due to the potency of the drug.

WRINKLE FINISH FOR FLEXIBLE MATERIALS

A WRINKLE finish composition has been developed by New Wrinkle, Inc., Dayton, Ohio, which can be applied successfully to various flexible materials such as paper, cloth, felt, as well as to metals. This synthetic resin base finish requires no cooking and may be baked at a relatively low temperature. This material can be applied to any desired texture by spraying, spreading or rolling. It is availalbe to the nearly two hundred licensees of New Wrinkle, Inc.

ORGANIC DETERGENT

A NEW type of synthetic detergent has been developed by the Solvay Process Co., New York. Carrying the brand name of Nytron, this product is a complex organic sodium sulfonate in which the hydrocarbon portion is derived entirely from a petroleum base. This material is said to have excellent detergent properties which, coupled with exceptionally high reistance to precipitation by calcium and magnesium salts, indicates its use as a water softener. Nytron is light buff in color, and is produced in granular or powdered form. Highly soluable in water it makes solutions up to 40 percent strength. Solutions are mildly alkaline running from a pH to 8.5 to 9.2, and are not harmful to coatings such as varnish and enamel.

While this material is available in experimental quantities only, it has potential uses in a number of different industries including textiles, laundries, pulp and paper, metal degreasing, insecticides, soap, etc. Because of its detergent, dispersing and wetting properties, together with its high solubility Nytron seems to have good possibilities for many domestic as well as industrial applications.

PROTECTIVE COATING FOR ALUMINUM ALLOYS

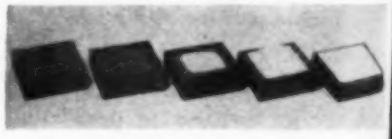
A NEW chemical treatment for aluminum alloys known as Alumox has been announced by the Enthone Co., New Haven, Conn. This coating is corrosion-inhibiting and serves to protect the aluminum against corrosive atmospheres such as salt spray and also presents an excellent base for organic finishes.

This finish is stated to be particularly suitable for non-copper-containing aluminum alloys where coatings can be obtained which will resist salt spray for 250 or more hours. While the finish obtained is grayish-green in color and may be satisfactory as such, the absorptive and adsorptive qualities of this material make it an excellent base for further treatment with other coating materials. The application of this coating requires no electric current and consists of immersing the aluminum in a dilute solution of Alumox salts at 210 deg. F. from 2 to 15 min.

RESIN IMPREGNANT

Two NEW liquid resins have been announced by the Furane Plastics and Chemicals Co., Los Angeles, Calif. for treating plaster of paris and Hydrocal forms. Plaster of paris is impregnated with Resin XP and Hydrocal is treated with Resin XR for the purpose of improving the physical properties of finished pieces, to increase the chemical and water resistance, to improve the heat resistance, and to make it possible to apply enamel coatings to various objects formed from this material.

Impregnation of forms, patterns, dies, etc. is accomplished by dipping, brushing or spraying the parts with the liquid resin after which they are cured in an oven. This produces a hard bone-like structure



Cross-sections showing various degrees of resin penetration obtainable

with physical properties comparable to cast plastics. Temperature resistance of the impregnated object is considerably higher than the untreated plaster of paris or Hydrocal, while water and chemical resistance are also increased substantially.

PLASTIC DYE

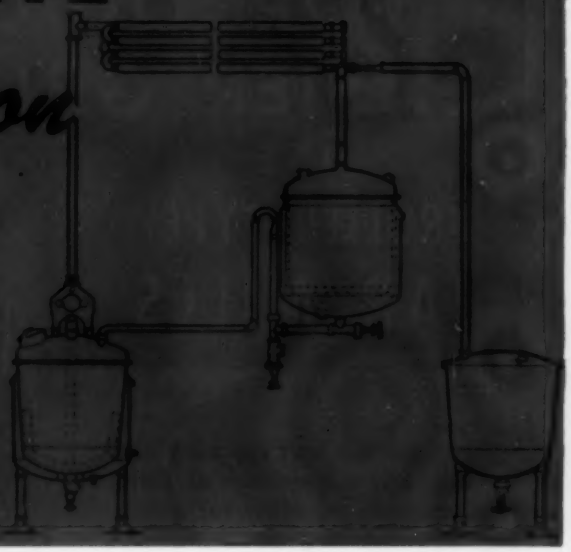
A BLACK plastic dye has been developed by the Krieger Color & Chemical Co., Hollywood, Calif., and is now available in the S, A, P and W types of plastic dyes produced by this firm. This black dye can be applied in 15 minutes, producing a permanent ebony shade and may be used on such plastics as Lucite or Plexiglas, cellulose acetate, Tenite, nitrate and vinylite, etc.

SYNTHETIC ENAMELS

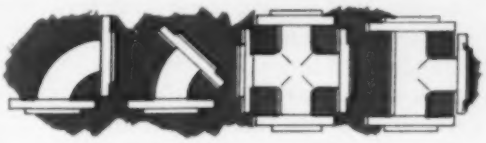
CERTAIN synthetic materials that were essential to the war effort have been used by the Arco Co., Cleveland, Ohio, to prepare a new group of all-synthetic, high bake enamels that give an exceptionally hard, stainproof finish designed to endure heavy household usage. These finishes with the brand name of Synox, are now being produced in several whites which have been thoroughly tested and adopted

100% COMPLETE *Process Protection*

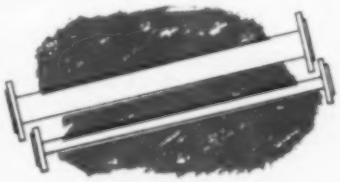
You can eliminate weak "links" in your process layout by the addition of Pfaudler glass-lined pipe, fittings and valves.



Have you stopped corrosion with glass-lined steel equipment in one stage of processing and overlooked it in another? Others have. How about your pipe lines, fittings and valves? Besides reactors, stills, condensers and storage tanks, Pfaudler makes a complete line of glass-lined pipe, fittings and valves. Some of the highlights of these lines are indicated below . . . and we'll be glad to send more complete information on request.



Flanged glass-lined fittings complete the all-glass-lined assembly . . . keep corrosion under control *all the way*. Standard 125 P.S.I. fittings include straight and reducing tees, elbows, crosses, reducers, bends, etc. from 1½″ to 12″. Special fittings are made on request. To obtain maximum service from glass-lined process equipment, it is important to select a proper gasketing material. Gaskets for all glass-lined connections are obtainable from Pfaudler.



Flanged glass-lined pipe is available in diameters of 1½″ and upward, lined with Pfaudler highly acid resisting glass. Maximum lengths: 1½″ size, 36″; all others, 10 ft. Standard pressure, 125 lbs. Heavy duty designs are in successful operation at pressures up to 300 lbs. Jacketed and unjacketed pipe also available as heat exchangers and condensers, connected in series or parallel by 180° glass-lined return bends. The inherent flexibility of the straight pipe return bend design results in a wide selection of heat transfer surfaces.

Pfaudler Heavy-Duty Glass-Lined Valves (flush, safety, and line) are built for rugged service. Limited pressure, 125 P.S.I. All valve bodies are made of cast iron, glass-lined, and are equipped with porcelain valve heads and seats which are free from mechanical and thermal strains. Flush valve openings: 2″ to 1½″; 3″ to 2″; 4″ to 3″. Safety and line valves: 1½″; 2″, 3″.

Perhaps Pfaudler glass-lined equipment could do a *better job for you* if utilized to fullest advantage. Our engineers will be glad to recommend complete glass-lined process assemblies with which to meet your conditions most economically. We welcome your inquiries and of course will be glad to send you literature. Write The Pfaudler Co., Rochester 4, N. Y.

Pfaudler

THE PFAUDLER CO., Rochester 4, New York. Branch Offices: 330 West 42nd St., New York 18, N. Y.; 111 W. Washington St., Chicago 2, Ill.; 1325 Howard St., San Francisco 3, Calif.; 455 Paul Brown Bldg., St. Louis 1, Mo.; 7310 Woodward Ave., Detroit 2, Mich.; 1318 1st Nat'l Bank Bldg., Cincinnati 2, O.; 1041 Commercial Trs. Bldg., Philadelphia 2, Pa.; 751 Little Bldg., Boston 16, Mass.; Box 902, Chattanooga 1, Tenn.

THE PFAUDLER CO., ROCHESTER 4, NEW YORK

ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT

Glass-Lined Steel . . . Stainless Steels . . . Nickel . . . Inconel . . . Monel Metal

FOR QUICKER, EASIER GRINDING

USE

"ROLLER-TYPE"

JAR MILLS

No cumbersome clamping into frames or housings—just set the jars on the rubber-covered rollers—and let them roll.

THERE just isn't anything like the ease and convenience of these "Roller-type" Jar Mills for grinding or pulverizing chemicals, pigments, minerals, etc. Savings in time and jar breakage alone quickly pay for the cost of the unit. Sturdy, rugged construction for long maintenance-free service; positive gear drive for smooth, certain grinding action. Revolving speed (with 1½ gal. jar about 50 R.P.M.).

Standard sizes accommodate one, two, three or four jars of the 1, 1½ or 2 gallon size. Larger sizes on special order.

"ROALOX" JARS

Positive locking white chemical stoneware wide-mouthed mill jar. Five standard sizes in capacities from 2¼ to 54 pints. Gasket comes out with cover. Rolls smoothly. For "Roller-type" or "standard" jar mills.

Write today for new Bulletin 210-G which describes and illustrates "Roller-type" Jar Mills, standard Jar Mills, Ball Mills, Adjustable Drum Rollers, Revolving Drum Tumblers, Chemical Stoneware, Porcelain and Steel-Jacketed Mill Jars.

SUCTION FILTERS

We offer a full line of Chemical Stoneware air-and-vacuum-tight Suction and Gravity Filters. Regularly stocked in five (5) standard types, from the small laboratory sizes to large, heavy-duty industrial units, all capable of withstanding a complete vacuum.

Strong, easy to clean, these Filters insure a perfectly clear filtration.

Acid, alkali and corrosion-proof throughout the entire body.

U. S. STONEWARE

AKRON, OHIO

by some of the country's largest household appliance manufacturers.

Tests have shown these enamels to have unusual resistance to water, alkalis, stains, and also resist normal fruit acids, vinegar, etc. Synox may be applied to clean steel, with or without a primer, and to aluminum and magnesium. Wide variations in temperature and time of baking are said to produce no detectable difference in color, film strength and abrasion resistance and despite its extreme hardness it is flexible enough to meet most service conditions.

CHAIN CONVEYOR LUBRICANT

IN THE PAST it has been common practice to use soaps for lubricating high speed chain conveyors but frequently this material caused corrosion and did an inadequate job of lubrication resulting in frequent shutdowns. A new liquid lubricant, known as Botlube, has been developed by Turco Products, Inc., Los Angeles, Calif., which is non-staining, soapless, non-corrosive and contains no oil. This material is said to have a high degree of wetting action; producing a thin but exceptionally durable film. Botlube is particularly useful in premixed bottling units and similar equipment.

RESIN ADHESIVE

RECENT developments in resorcin-based adhesives have resulted in the manufacture of a new product indentified as Penacolite G-1215. A room temperature setting resin adhesive, it is now commercially available from the Pennsylvania Coal Products Co., Petrolia, Pa.

Exceptionally high strengths are said to be obtained in wood joints glued at a temperature of 75 deg. F., which when fully cured may reach strengths well over 3,000 lb. per sq. in. In general this material shows outstanding strength and durability properties when cured at room temperature and when elevated temperatures are employed considerably accelerated cures are obtained.

In many hot press applications Penacolite G-1215 may be mixed with walnut shell flour and water to produce an extremely rapid curing, inexpensive durable adhesive. In addition to being an excellent adhesive for wood, this material produces durable high strength bonds with phenolic laminates and moldings, many other plastics, fabrics, leather and rubber.

Prices of this material are said to be considerably lower than some of the earlier developed adhesives which are comparable in character.

ALL SYNTHETIC TIRES

ANNOUNCEMENT of a new all synthetic passenger car tire has been made by the B. F. Goodrich Co., Akron, Ohio. On the basis of extensive tests, this new tire is said to achieve better wear, cooler running, and greater resistance to cracking and carcass bruising than the conventional passenger car tire. One reason for improved performance is that a new synthetic rubber is used. GR-S 10, as it is called, is made with a rosin-base soap instead of the fatty acid soap in emulsification of the latex.

Perhaps more important is the improve-

There's a Monsanto Intermediate for almost every requirement

Monsanto intermediates find application in a wide variety of products. And users have discovered that Monsanto intermediates are always of the same high, dependable quality. That's because of Monsanto's careful research and precise manufacturing. Samples of Monsanto intermediates for your own experimentation, together with technical data will be sent on request. Contact the nearest Monsanto office or write:

MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second St., St. Louis 4, Mo. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

"NO INSTRUCTIONS NEEDED WITH THIS EXTINGUISHER!"

Cumbersome, antiquated extinguishers can delay and panic employees—your *real* fire-fighters!

Randolph "4", lightweight and easy to use, is designed for the amateur. Just ONE HAND snaps this unit from its bracket . . . one trigger-touch sends an icy cloud of carbon dioxide deep into the blaze—smothers gasoline, oil, paint, machine and electrical fires in *split-seconds!*

A dry, non-toxic gas, carbon dioxide cannot damage equipment or conduct electricity. It leaves no stain or liquid—no shut-down from water damage.

See, by actual demonstration, how fast-action Randolph "2", "4", "15" or "25" can mobilize and simplify *your* fire defense. For fire protection guidance and prompt delivery of equipment, call your nearest supplier, or write—

RANDOLPH LABORATORIES, INC. 8 EAST KINZIE STREET CHICAGO 11, ILL., U. S. A.

ment in tire construction in which a wider, flatter profile tread, or "road-level tread," produces longer and more uniform tread wear. This places more rubber in contact with the road and means less scuffing, better distribution of weight, better traction, quicker stops and more safety on turns. This construction is made possible by the greater carcass strength that has been built into the tire through the use of stronger cotton cord and by increasing the number of cords per in. in the plies. Greater resistance to cracking is brought about by better tread design and resistance to carcass separation is increased by using two breaker strips instead of only one.

DIP COATING FOR CADMIUM AND ZINC

CORROSION protection for cadmium and zinc may now be provided by a Unichrome dip which converts the surface to chemically inert compounds. The manufacturer, United Chromium, Inc., New York, N. Y., claims that parts require only a single immersion in Unichrome dip for from 2 to 5 min. at room temperature to give either black or olive drab finishes, which prevent the formation of white corrosion products as well as provide an excellent base for paints or lacquers. Standard salt spray tests for periods up to 200 hr. have shown this material to offer an unusual degree of protection.

ORANGE PIGMENT

LIMITED quantities of a new color—a bright, reddish shade of orange—are available from Geigy Company, Inc., New York, under the brand name Diphenyl Fast Orange 3RSP. It is projected for use on bond, bristol cover, tissue and wrapping specialties, and is recommended for its resistance to light, acid, and alkali.

HARD-FACING ALLOY

AN ALLOY for facing the valves of automotive engines has been developed by the Eaton Manufacturing Co. of Detroit. Known as Eatonite, the metal is notable not only for its hardness but also for its ability to retain hardness at the high temperatures of high compression engines and for its ability to resist corrosion by high test anti-knock gasoline. Laboratory tests are reported in which engines were run the equivalent of 200,000 miles without valve refacing or sign of any serious wear or corrosion.

FIRE QUENCHER

ANNOUNCEMENT has been made of the development by Wyandotte Chemicals Corp. of an unspecified liquid chemical, known as Ammudamp, designed to quench fires set off in the ammunition magazines of tanks that have been struck by shell fire. The fire extinguishing liquid is put in cannisters and the cannisters distributed around all sides and through the middle of the magazine. Thus, any projectile that pierces the magazine also pierces some of the cannisters and Ammudamp is released to help extinguish flaming ammunition.

Ammudamp is not the only product that has been tried as a safeguard against tank burn-outs, but it is the one finally

You can *put your finger on the* **EXTRA** **LOAD-CARRYING CAPACITY** in these

SPEED REDUCERS

ONE look at the continuous tooth herringbone gears in a Farrel Speed Reducer tells you what gives these gears their extra strength and load-carrying capacity.

In place of the center groove found in some herringbone gears, you see the extra tooth area formed where the helices meet to make the teeth continuous across the face. This extra tooth area is known as the *backbone*. It puts the entire width of the gear to work, providing greater capacity to withstand shocks, stresses and heavy loads.

Precision generated by the famous Farrel-Sykes process, the *Gear with a Backbone* is widely known throughout industry for its smooth, quiet, efficient operation. Its combined characteristics of overlap or interlacing of the teeth, gradual engagement and inclined line of pressure distribute the load on the teeth uniformly, reducing wear and maintaining correct tooth action through a long gear life.

Other features which contribute to smooth, efficient power transmission in Farrel Speed Reducers include rigid and accurately ground shafts properly mounted in roller bearings, and heavy section cases that hold rotating elements in precise alignment.

These speed reducing units are available in a complete range of sizes for any capacity. Ratios of single reduction units range from 1¼:1 to 10:1, double reduction units up to 60:1, and triple reduction units up to 180:1. Write for descriptive Catalog No. 438.

Farrel-Birmingham

FARREL

FARREL-BIRMINGHAM COMPANY, INC.
344 Vulcan St., Buffalo, N. Y.
Plants: Ansonia, Derby and Stonington, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles, Tulsa, Houston, Charlotte.

FB-230

SEMCO
LININGS
provide long time trouble-free operation wherever acids, alkalies, corrosive gases or vapors are encountered.

For sixty years, Stebbins has been designing and installing linings for practically every known type of process reaction vessel or treating tank. Process plants of many types have utilized Stebbins service again and again — fitting testimony to the quality and durability of our linings.

Stebbins can furnish linings of brick, tile, porcelain and carbon materials for both acid and alkali conditions. For certain specific requirements our resin membranes, resistant coatings and rubber films, in combination with brickwork, are most effective.

Next time you have a lining problem involving acids, alkalies, corrosive gases or vapors—call in Stebbins. Get the benefit of the experience of engineers and designers familiar with the chemical and mechanical requirements of the various processes. Possibly our Research Department has already developed a special material or formula that will give a satisfactory answer to your lining problem. All materials used by Stebbins in the construction of linings have been tested in the Stebbins Research Department.

Stebbins Engineering and Manufacturing Company
367 EASTERN BOULEVARD WATERTOWN, NEW YORK

accepted as standard for all light and medium tanks built in the United States. Chief reasons for the Army's selection are that Ammudamp has very high surface wetting power, will not freeze above —55 to —65 deg. F., and will not corrode metal or deteriorate with age. Unlike a previous fire-quenching agent that actually became flammable on dehydration, Ammudamp remains safe and effective.

LIGHTWEIGHT APRONS

Acid, alkali, and oil resistant aprons made of fabric coated on one side with a black vinyl resin are now being produced by the B. F. Goodrich Co., Akron, Ohio. They are designed primarily for strength and durability to provide a product suitable for workers in canneries and various chemical industries. Two sizes are available, 29x35 in. and 35x45 in.

GUMMED LABELS

It was recently announced that gummed plastic plates, bearing any message the customer desires from nameplate data to "Please turn out the lights," can now be obtained in all sizes and colors from the Pennsylvania Plastic Corp. of Pittsburgh. The plates, being plastic, are not stiff and may be attached to any shaped or curved surface. Application is made simply by cleaning the surface in question with a solvent as benzene or naphtha, moistening the back of the plate with the same solvent, and pressing the plate in place. It is claimed that after 24 hr. the attachment is permanent—much more so than a decal —and it is unaffected by most weather conditions.

Brand name of the product is Everstick Plastic Plate. It is proposed for such applications as nameplates, switch handles, instrument panels, machine guards, dials, and advertising displays.

BLASTING CAP

Recently the Du Pont Co. announced that it has developed a blasting cap which, on two counts, is superior to older detonators used to set off dynamite charges. It is smaller by about half and it is more nearly foolproof.

Improvements stem from the use of a better type waterproof closure for the cap. Instead of the old asphaltic waterproofing compound with a plug of sulphur to hold the asphalt in place, the new cap is sealed with a crimped-in plug of rubber only slightly larger than a pencil eraser. The old asphalt-sulphur closure was imperfect in that the waterproofing softened in the heat and shrank in the cold, permitting water to leak into the cap; the new rubber plug closure remains waterproof under any climatic condition.

The number of old-style caps that failed for this cause was very small indeed, but even the rare failure can have disastrous consequences. For example, if just one charge in a hundred-hole shot fails to go off, it means that a charge of dynamite is buried somewhere in the pile of rock or earth to be cleared away by workmen and power shovels. To further improve waterproofness and reduce misfires, the electric lead wires attached to the new cap are coated with a solid (not woven thread or yarn) layer of nylon plastic.

CHEMICAL ENGINEERING NEWS

ENGINEERING GROUP FORMULATES FIVE-POINT PROGRAM FOR STRICT CONTROL OF GERMAN INDUSTRY

LAST FEBRUARY, the National Engineers Committee of the Engineers Joint Council was requested to make a study and to suggest measures for postwar control of German war potential. The request of the Council was supplemented by the approval of the State and War Departments. The scope of the committee's studies includes industrial control of all aggressor nations but the first report, recently completed, deals entirely with Germany. Thirty-five engineering and technological specialists in their respective fields cooperated in the preparation of the report and recommendations. Copies have been laid before the heads of the State Department, the War Department, the Navy Department, the Commanding General of the Army Service Forces, the Foreign Economic Administration, and General Lucius D. Clay, deputy to General Eisenhower for U. S. Group Control Council for Germany.

Working within the framework of the Yalta and Potsdam agreements, the engineering group concludes that assurance that Germany will keep the peace, requires institution and maintenance of effective controls of power production and distribution and industrial plant construction to: (1) Prohibit the synthetic fixation of nitrogen (2) prohibit the production of synthetic liquid fuels (3) prohibit the production of aluminum (4) prohibit the development or use of atomic energy (5) limit the capacities and production of steel and steel products plants.

It also is proposed to eliminate danger from secret scientific research by preventing coordination of such efforts with development facilities under German control. Economic subsidies to industry by the German Government also are ruled out as a fruitful source of future war strength.

Recommended controls would reduce employment of the total peacetime labor force in Germany by about 5 percent, a displacement which should be absorbed easily by reemployment in peacetime agriculture and consumer goods industries.

The report details the industrial factors that must be controlled, supporting its findings with statistics and engineering data, but leaving the determination of the specific methods of control to the authorities charged with that function. These factors include energy allocation; raw material elimination or limitation applied to specific elements critical to war industry; processing, fabricating and new construction; scientific research; and economic subsidies.

Referring to the individual industry factors, the report states that the fundamental factor is energy since it is required in one form or another to operate all processing equipment. Control of power distribution through allocation of coal would be cumbersome. A rigid control of electric power distribution is therefore important to ensure regulation of German industry. Excess capacity above allocations, including installations in industrial plants, should be removed and all the contiguous auxiliaries, building foundations and other services should be removed or destroyed.

Turning to nitrogen, the report favors elimination of all German production of synthetic fixed nitrogen except cyanamide, this to include all processes and equipment suitable for hydrogenation of coal or hydrocarbon oils and for the production of synthetic ammonia or methanol. Chemical nitrogen production would be limited to the byproduct output of the permitted steel industry. The needs of Germany in excess of the recommended domestic production can be supplied in the form of synthetic and natural nitrates from other countries, this also applying to industry needs for anhydrous ammonia. Finally it is recommended that German citizens, corporations, the German government, or any instrumentality thereof, be prevented from obtaining complete or partial control or any financial interest in any nitrogen fixation plants in any country.

The recommendations regarding synthetic fuels are drastic calling for the entire elimination of the industry. It is pointed out that allowing this industry to continue would tend to maintain knowledge and technique of manufacture and would give a foundation for rapid expansion and conversion to a definite war potential.

With respect to aluminum, it is advocated that manufacture of the metal from raw materials be prohibited and that Germany be given only enough of the metal for peacetime uses; all alumina producing and smelting plants to be eliminated. It is further recommended that imports of bauxite or any alumina ores be prohibited except for a limited amount to be used as such without smelting. Also that production of petroleum coke and carbon paste be stopped. The electrical process for smelting aluminum requires about three-quarters of a pound of carbon for electrodes per pound of aluminum.

The possibility of the use of atomic power was not overlooked as one portion of the report states that it is recognized that the principles of atomic energy may be known to German scientists during the period of the contemplated tenure of these regulations, but it is believed that control of such development will be readily obtained through the rigid regulation of all construction and control of power requirements, to preclude the possibility of construction of plants for the development of such atomic energy.

Suggestions are advanced for limiting the output of steel and steel alloys to meet actual peacetime requirements with a corresponding check on imports of ores and finished products. The re-equipment of steel mills also should be studied for the purpose of eliminating such as could be readily converted to the production of instruments of war. While all the recommendations have a certain bearing on new construction it is specifically recommended that a rigid control of all new construction be maintained through the issuance of permits by a board made up of experts in all potentials of war production.

The National Engineers Committee consists of Robert E. McConnell, New York, chairman; Harry S. Rogers, president of Brooklyn Polytechnic Institute, vice chairman; Thomas F. Barton, commercial vice president, General Electric Co.; Colonel Carlton S. Proctor, consulting engineer, New York; Dr. Edward R. Weidlein, director, Mellon Institute of Industrial Research, Pittsburgh and Dr. Clyde E. Williams, director, Battelle Memorial Institute, Columbus, Ohio.

CHEMICAL SHOW TO BE HELD IN GRAND CENTRAL PALACE

AMONG the first of postwar industrial expositions to be announced is the Twentieth Exposition of Chemical industries which is being organized for the week beginning February 25 in Grand Central Palace, New York. The building had been used by the Army as an induction center. The announcement was made by Charles F. Roth, president of the International Exposition Co., under whose direction the exposition will be held.

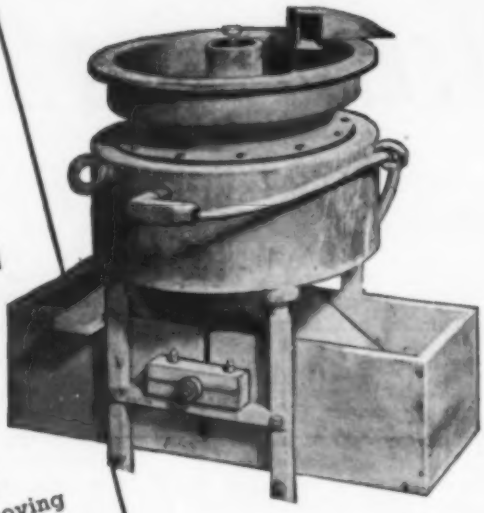
Coming at a time when industries are in the process of reconversion the exposition will serve as an accelerator, providing opportunities for personal contact and business conferences between principals, technical staffs, manufacturers and professional consultants. Many new products and processes are expected to be on display. Other new methods and products, shelved during the war, are emerging as byproducts to round out the economic formulas.

Mr. Roth will be assisted by E. K. Stevens as well as by an advisory committee composed of industrial leaders, of which M. C. Whitaker, vice president of American Cyanamid, is chairman. It is reported that a large portion of the display space on three floors of the Palace already has been requested by exhibitors.

SHELL CHEMICAL WILL TAKE OVER EASTERN SALES

SHELL CHEMICAL division of the Shell Union Oil Corp. will take over all phases of the distribution of its products in the eastern United States on Jan. 1, 1946, according to an announcement made by L. V. Steck, vice-president in charge of marketing. G. R. Monkhouse, formerly with Shell Oil Co., Inc., as division man-

How to Remove Iron From Liquids



Dings Wet Type Separators provide the most effective method yet devised for removing iron from ceramic slip and glaze, inks, foods, paper pulp, oil, cutting compounds, etc. These High Intensity units are the result of nearly 50 years of specialization in the manufacture of magnetic separators. Send today for factual, illustrated bulletins.

Dings De-Ironer

This high capacity separator removes iron of microscopic size and other less magnetic materials. Non-corrosive grids, powerful coil, and hundreds of feet of iron-catching edges. Open or closed types with bronze outer shell. Only one sliding contact in valve. Automatic safety valve in case of current failure.

Dings Type U Separator

For removing particles of iron or iron oxides from liquids. No moving parts. Magnets are staggered to completely cover solution area and provide maximum arrest of tramp iron.

Dings Type T Separator

Effectively removes iron particles when unit is lowered into any tank or spout. Easily cleaned by withdrawing separator from solution, interrupting the current and allowing accumulated iron to discharge.

DINGS MAGNETIC SEPARATOR COMPANY
505 E. Smith Street
Milwaukee 7, Wisconsin

Dings
"HIGH INTENSITY"

ager in Minneapolis and recently in the U. S. Army as Lt. Colonel attached to Supreme Headquarters AEF, will be general manager of the newly constituted eastern division of the company. J. M. Selden, vice-president of R. W. Greeff & Co., Inc., will join Shell as sales manager in charge of marketing for the new organization and M. L. Griffin will become administrative assistant to the general manager.

R. W. Greeff & Co. have been Shell Chemical's representatives in the east for the sale of solvents for the past fifteen years and will contiue their association with the company as marked consultants.

MILITARY CHEMICALS SEEKS JAYHAWK ORDNANCE WORKS

Reports from Kansas state the Military Chemical Co., a wholly owned subsidiary of the Pittsburg and Midway Coal Mining Co., is negotiating for the purchase of the Jayhawk Ordnance Works near Pittsburg, Kans. Kenneth Spencer, who is president of both the chemical and mining companies, has stated that the Military Chemical Co. has notified the Army it was going to exercise its recapture options for a lease-purchase of the property. He added that negotiations are being completed for acquisition on a basis supported by government engineering studies. The chemical company continues to operate the plant on a cost plus fee basis although production since August 11 has been for civilian use. The ammonia produced is being sold through the Commercial Credit Corp. with a considerable part of the output said to be going abroad.

Current plans are said to call for a monthly production of 10,000 to 12,000 tons of anhydrous ammonia. Some of this material will be shipped to the Kansas Ordnance Works at Parsons, Kans. where it will be put through the graining facilities at that plant. Long range plans of the Military Chemical Co. include using the Jayhawk plant for making ammonia with an expansion program to make methanol, dry ice, liquid carbon dioxide, and a nitrate crystallizing plant.

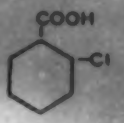
EASTMAN EXPANDS ANNUAL FELLOWSHIP GRANTS

To assist universities in reducing the postwar dearth of young men with advanced technical training, the Eastman Kodak Co., Rochester, N. Y., is expanding its granting of annual fellowships into a well rounded program of aid to graduate students of chemistry, physics, mechanical and electrical engineering, and business administration. This expansion takes the form of providing 12 fellowships for doctoral work and 10 fellowships for master's work. The previous Eastman Kodak grants were confined to the field of chemistry and numbered only six.

Of the awards to be granted persons pursuing doctoral training, one fellowship is designated for chemical engineering at the Massachusetts Institute of Technology; another is for work in organic chemistry at the University of Illinois; and another is for the study of physical chemistry at the University of Rochester. The nine other fellowships for doctoral work—six in chem-

ORTHO CHLOR BENZOIC ACID

High melting, nearly white, coarse powder



Molecular Weight	156.5
Assay (dry basis)	98.5%
Ash (maximum)	0.20%
Melting Point (minimum)	137.0°C.

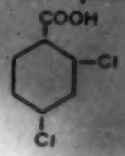
PARA CHLOR BENZOIC ACID

High melting, nearly white, coarse powder

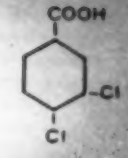
Molecular Weight	156.5
Assay (dry basis)	98.5%
Ash (maximum)	0.30%
Melting Point (minimum)	238.0°C.

2,4 DICHLOR BENZOIC ACID

White to slightly yellowish powder



Molecular Weight	191.
Assay (min. on dry basis)	98.0%
Ash (maximum)	0.20%
Melting Point	158-162°C.



3,4 DICHLOR BENZOIC ACID

White to slightly yellowish powder

Molecular Weight	191.
Assay (min. on dry basis)	95.0%
Ash (maximum)	0.20%
Melting Point	205-207°C.

CHLORINATED BENZOIC ACIDS

USES—As intermediates for the preparation of anti malarials, dyes, fungicides, pharmaceuticals and other organic chemicals.

Samples, technical data sheets and further information available upon request.

HEYDEN *Chemical Corporation*

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istry and three in physics—are to be rotated among various universities from year to year.

Tennessee Eastman Corp., Kingsport, Tenn., a subsidiary of Eastman Kodak, also has announced the establishment of a postgraduate doctorate fellowship in textile chemistry and two postgraduate master-degree fellowships, one in textile engineering and one in textile chemistry. The latter two fellowships will be awarded to different institutions each year.

FUTURE OF ATOMIC POWER

Speaking before the Chicago Association of Commerce on October 9, Arthur H. Compton, of the University of Chicago, made the first definite prediction regarding the future use of atomic power that has been voiced publicly by a scientist associated prominently with the Manhattan Project. Said Dr. Compton, regarding the chain reacting pile, "Within 10 years it is not unlikely that power companies designing new plants for city service will consider the use of uranium instead of coal for purely economic reasons." He stated that chain reacting piles have already been built to employ uranium containing more than the usual fraction of U-235, and that such piles were much smaller than those now in use. However, because of the massive shielding required, there is no hope that atomic power units for normal use can be built to weigh less than perhaps 50 tons, a fact that appears to rule out applications such as the powering of automobiles and airplanes of ordinary size.

DOW MAKES LELAND I. DOAN DIRECTOR OF SALES

THE Dow Chemical Co., Midland, Mich., has elevated Leland I. Doan to the position of director of sales. He began his career with Dow in 1917 and for the last 16 years has served as general sales manager. He has been a vice president of the company since 1936 and secretary since 1941. He also holds offices and directorships in various Dow subsidiaries.

The new director of sales has appointed Donald Williams to succeed him as general sales manager and Donald K. Ballman as assistant general sales manager. Mr. Williams joined the Dow company in 1924 as a member of the sales staff and has been assistant general sales manager since 1933.

CHEMICAL MARKET RESEARCH MEN MEET IN WASHINGTON

THE relationship between Department of Commerce services and chemical marketing studies was widely discussed during the Sept. 12 meeting of the Chemical Market Research Association in Washington. Many economists and market analysts attended the all-day session. Morning and afternoon meetings were held in the Department of Commerce auditorium. Lunch and dinner gatherings were in the Mayflower Hotel. James G. Park, president of the association, presided.

Officials of the Department of Commerce, Tariff Commission, F. E. Ber-

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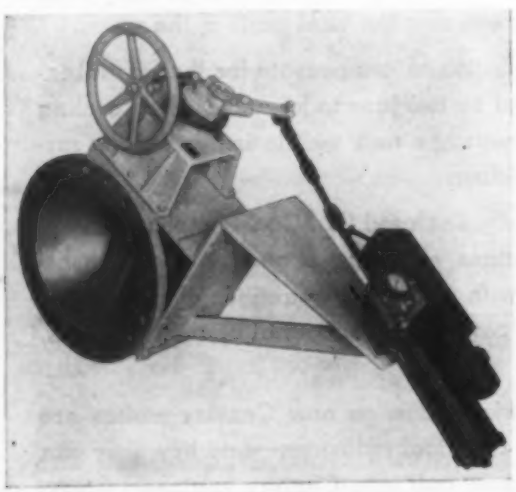
The opening or closing time of the valve vane can be varied from one second to an interval of several minutes. Such quick or slow action, coupled with the natural low head loss due to the valve design, means a *large saving in power on pumping operations* and wide adaptability in the handling of a multitude of materials.

These valves are also adapted to elevated or sub-zero temperatures. 15 to 900 psi.



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R-S Streamlined BUTTERFLY VALVES

quist, Office of Plant Disposal, RFC, and Walter J. Murphy, editor of *Industrial and Engineering Chemistry*, were among the principal guest speakers. Secretary of Commerce Wallace made a few remarks during the afternoon. Improvements in the government's statistics, and means of improving analyses and forecasts, received much attention during the meeting.

MATHIESON DOUBLES SODIUM CHLORITE PLANT CAPACITY

A NEW plant which will double the output of sodium chlorite is now being added to the Niagara Falls production facilities of The Mathieson Alkali Works, according to an announcement made by George W. Dolan, president of the company. Construction cost of the new building is estimated at $35,000 and its total cost at about $323,000.

Sodium chlorite was made commercially available by Mathieson in 1940. Since then, its major uses have been as a bleach and oxidant in the textile and paper pulp industries. During the past year, it has come into use for the removal of tastes and odors in a new process for treating public water supplies, but only a few cities have been able to take advantage of this development, Mr. Dolan stated, because of the inadequate supply of the chemical.

PLANS PROPOSED ON DISPOSAL OF ALUMINUM PLANTS

LATE last month the Attorney General and the Surplus Property Board submitted independent reports to Congress recommending establishment of new conditions in the aluminum industry to further competition. SPB called for disposal policies tending to put the vast system of government-owned aluminum plants into hands of competitors of the Aluminum Co. of America. Attorney General Clark, supporting the viewpoint of SPB, suggested the dissolution of Alcoa into competing companies if increased competitiveness of the industry is not achieved through disposal of the government plants.

A rejoinder in behalf of Alcoa was quickly issued. The statement, released by Carl Byoir and Associates, Washington, D. C., said that Clark's report to Congress "... stresses government subsidy on which no sound competitive condition can be built in any industry. The report of the Attorney General is an argument for government subsidies to operators of government-owned aluminum plants." As for the question of monopoly, "The Circuit Court of Appeals also found that Alcoa had no monopoly in raw materials or in any fabricated aluminum products and directed that the issue of whether Alcoa had a monopoly of the smelting of aluminum should be determined only after the disposition of the government-owned plants."

COOPERATIVE TRAINING PLAN ANNOUNCED FOR R.P.I.

A COOPERATIVE plan with industry to aid in replenishing the supply of scientific and technological personnel, will get under way at Rensselaer Polytechnic Institute on November 1. In making the announcement, Livingston W. Houston, president

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Type FS Two-Gang Tandem Vaportight Condulet with Switch and Plug Receptacle
Type MSR Two-Gang Watertight Marine Interlocked Switch and Receptacle Condulet
Type EGP Explosion-Proof Mercury Switch Condulet for Panel Mounting
Type FLDC Explosion-Proof Secondary Breaker Condulet
Type FLS Explosion-Proof Switch Condulet
Type DXE Condulet with Two Switches
Type GSB Three-Gang Vaportight Condulet with Switches
Type ZT Safety Switch Condulet
Type WMX Watertight Safety Switch Condulet
Type WMES Watertight Safety Switch and Interlocking Receptacle Condulet
Type EGP Explosion-Proof Push Button Station and Pilot Light Condulet for Panel Mounting
Type FSQC Explosion-Proof Interlocked Receptacle and Switch Condulet
Type GUB Explosion Proof Motor Starting Switch Condulet
Type FST Threadless Condulet with Switch
Type FA Four-Gang Watertight Safety Switch Condulet
Type FS Condulet with Pilot Light, Switch and Plug Receptacle
Type GRF Condulet with Switch
Type EFS Explosion-Proof Switch Condulet
Type GUSC Explosion-Proof Line Starter Condulet
Type EFS Explosion-Proof Push Button Switch Condulet
Type FS Two-Gang Watertight Marine Switch Condulet
Type EFSBC Two-Gang Explosion-Proof Push Button Station and Pilot Light Condulet
Type EFD Explosion-Proof Motor Starting Switch Condulet
Type HBC Explosion-Proof Mercury Switch Thermostat Condulet
Type FBC Vaportight Push Button Station Condulet
Type MSR Three-Gang Watertight Marine Switch and Receptacle Condulet
Type FHBC Mercury Switch Thermostat Condulet
Type EFS Two-Gang Explosion Proof Push Button Switch Condulet
Type HR Explosion-Proof Thermostat Condulet
Type FS Vaportight Push Button Station Condulet
Type FG Door Switch Condulet
Type EFBC Explosion-Proof Control Station Condulet
Type DVS Dust-Tight and Vaportight Circuit Breaker Condulet
Type YEW Vaportight and Weatherproof Circuit Breaker Condulet
Type DVS Dust Tight and Vaportight Circuit Breaker Condulet
Type EFBC Explosion-Proof Triple Switch Condulet
Type OFC Explosion-Proof Push Button Station Condulet
Type FDC Vaportight Secondary Breaker Condulet
Type FS Vaportight Condulet with Three Switches
Type EPC Explosion-Proof Circuit Breaker Condulet
Type FS Five-Gang Condulet with Switches and Plug Receptacles
Type FS Three-Gang Condulet with Switches
Type WBR Weatherproof Circuit Breaker and Receptacle Condulet
Type FGCH Explosion-Proof Switch Condulet for Gasoline Bulk Stations

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"Shine 'em up"

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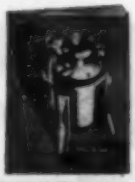
A request on your letterhead will bring our guide, "What to Look For When You Specify Stainless Steel for Your Processing Equipment."



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of the Institute stated that this country finds itself short approximately 150,000 engineers who would have been graduated during the war period under normal conditions, not to mention war casualties. He said the shortage is proportionately more acute in the number holding master's and doctor's degrees and the new plan is aimed particularly at the latter need as it differs from the usual college-industry plan in that it wall carry students through at least to the master's degree and enroll only those who indicate talent and ability for graduate study and research.

The General Electric Co. has agreed to participate in training as many as 80 men at a time and other nationally known companies are arranging to take part in the program. While studying various branches of engineering, physics, and chemistry, the students will spend about 30 percent of their time in shops or laboratories of the industries for which they will receive wages.

S. C. JOHNSON & SON, INC. ESTABLISH FELLOWSHIPS

Six graduate fellowships for work in the chemistry and chemical engineering of wax have been established by S. C. Johnson & Son, Inc., Racine, Wis. Dr. J. V. Steinle, research and development director of the company, stated that the grants total $30,500. The colleges selected with the amount of grant and the professor in charge are: Massachusetts Institute of Technology, $5,000, Prof. E. A. Hauser; University of Wisconsin, $4,500, Prof. H. A. Schuette; Cornell University, $7,500, Prof. F. H. Rhodes; Ohio State University, $4,500, Prof. J. B. Brown; Michigan State College, $3,000, Prof. V. R. Gardner; and Northwestern University, $6,000, professor not yet selected.

OIL CHEMISTS WILL HOLD FALL MEETING

With the lifting of the ban on meetings and conventions, the American Oil Chemists' Society has announced it will hold its customary fall meeting. It will be held at the Hotel LaSalle in Chicago on November 7-9. George A. Crapple of Wilson & Co. will serve as chairman of the convention and W. B. Hendrey of the Edwal Laboratories heads the committee which is preparing the program.

JEFFERSON CHEMICAL WILL BUILD AT PORT NECHES

Some months ago it was announced that the Jefferson Chemical Co. had been formed by the American Cyanamid Co. and The Texas Co. for the purpose of manufacturing chemicals in Texas. It has now been announced that the company will erect a plant on part of a tract of 1,091 acres east of and adjacent to The Texas Co.'s asphalt and roofing plant at Port Neches. Products to be made in the new plant will include intermediate chemicals for the manufacture of synthetic rubber, plastics, textiles, and other products from petroleum and petroleum gases.

Construction work is expected to start in November or December and will take about a year to complete. It is planned to

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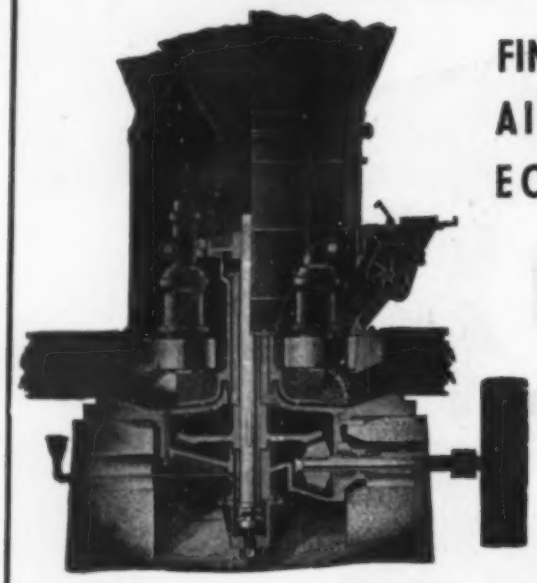

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- INCREASED CAPACITY
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- GREATER OPERATING CONVENIENCE
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GRINDING and DRYING ...ONE OPERATION

The Williams Roller Mill has been used for a number of years on all types of medium to extremely fine grinding and is generally conceded to be the most economical for work in this field, both in lower power consumption and maintenance. Our unusually accurate air separators provide a positive check on the size of the finished product. Only material of the desired fineness passes through the air separators—all oversize particles are returned to the mill for re-grinding.

From the standpoint of economical and correct processing, drying and grinding is now logically One Operation. By combining these operations you effect a saving not only in a high purchase price and installation expense of separate drying equipment, but also in the final cost per ton of material handled.

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PATENT CRUSHERS GRINDERS SHREDDERS

install initially, a combination laboratory and office building, locker building and gate house, all of brick construction. The plant itself will consist of two major processing units with fractionating towers and heaters.

Coinciding with this announcement it was made public that the American Cyanamid Co. is consummating the purchase of about 900 acres immediately east of the Jefferson site upon which it will build a chemical plant utilizing some of the products made by Jefferson.

HARSHAW SPONSORS RESEARCH IN INORGANIC CHEMISTRY

A GIFT of $15,000 from the Harshaw Chemical C. of Cleveland to Western Reserve University for the furtherance of research in inorganic chemistry was announced on October 3 by Winfred G. Leutner, president of the university. In making the announcement President Leutner said the fund will support two fellowships in a three-year program of research under the direction of Dr. Harold S. Booth, professor of chemistry. Applications for these fellowships could be sent to the Dean of the Graduate School, Western Reserve University, Cleveland 6, Ohio.

COMMERCIAL LABORATORIES COUNCIL WILL MEET

DECEMBER 10-11 have been selected as the dates for holding the annual meeting of the American Council of Commercial Laboratories according to an announcement sent out by secretary A. J. Nyde of New York. The meeting will be held at the Palmer House, Chicago. The Council is an association of leading commercial laboratories throughout the country. Major W. P. Putnam, president of the Detroit Testing Laboratories, is its president.

STANDARD OIL OF INDIANA BUILDS RESEARCH PLANT

CONSTRUCTION is under way on large new research laboratories for the Standard Oil Co. of Indiana on land recently acquired in Hammond near the Whiting refinery. The building program includes a main administration building, general laboratories, three pilot-plant units, and a cafeteria. Later it is planned to include an engine laboratory, a greenhouse for insecticide work, additional pilot plants, and other research facilities.

ALUMINUM OUTPUT DROPPED SHARPLY LAST YEAR

THE Bureau of Mines has reported that primary aluminum output in 1944 dropped 15.6 percent from the preceding year in a reversal of a production trend which had climbed steadily for the previous five years. Production had increased from 206,280 short tons in 1940 to a peak of 920,179 short tons in 1943 but fell to 776,446 short tons in 1944.

Owing to growing stocks and to reduced military requirements during 1944, the annual rate of production dropped from 1,017,000 in January to 560,000 tons in December. Reduction in output was effected throughout WPB cutbacks.

Top quality Precision-Engineered Valves

—that only experienced master craftsmen and unceasing research can provide.

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LUBRICATION PLUS!

A SUPER LUBRICANT—A MARVELOUS ANTI-SEIZE COMPOUND—A REAL PROTECTION AGAINST RUST AND CORROSION. From the standpoints of general utility and wide diversity of important uses, we do not believe there has ever been a lubricant that compares with LUBRIPLATE No. 130-A. It has everything. The outstanding performance of this super-lubricant and its adoption by industry in general, and the Army and Navy are certainly adequate proof of its superiority. Write for copy of bulletin No. 6-41.

LUBRIPLATE
Lubricants definitely reduce friction and wear to a minimum. They lower power costs and prolong the life of equipment to an infinitely greater degree. LUBRIPLATE arrests progressive wear.

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Lubricants protect machine parts against the destructive action of rust and corrosion. This feature alone puts LUBRIPLATE far out in front of conventional lubricants.

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Lubricants are extremely economical for reason that they possess very long life and "stay-put" properties. A little LUBRIPLATE goes a long way.

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OUR 75TH YEAR
1870 - 1945

READERS' VIEWS AND COMMENTS

CALCIUM PRODUCED BY ALUMINOTHERMIC PROCESS

To the Editor of Chem. & Met.:

Sir:—I would like to draw your attention to the article "Calcium—Produced by Ferrosilicon Process" on page 94 of your August issue.

It should be mentioned that no ferrosilicon whatsoever is employed in the process described. The second line of the title, therefore, is incorrect and misleading.

The calcium is produced by the aluminothermic process and should presumably be so described.

L. M. PIDGEON

University of Toronto
Toronto 5, Canada

SOLDERED-JOINT FAILURE

To the Editor of Chem. & Met.:

Sir:—May we make a suggestion as to the failure of soldered socket joints described in the article by P. B. Petty on "Metals for Service at Sub Zero Temperatures," in the June issue of *Chem. & Met.*?

We believe this to be due to the well-known allotropic modification undergone by tin at sub-zero temperatures to the brittle beta tin. Since this occurs with volume expansion, the tin falls to a gray powder, the maximum rate of change being about —40 deg. C.

In some of the earlier Antarctic expeditions, notably that of Scott, great trouble was experienced through leakage of gasoline cans due to this failure of their soldered joints in the sub-zero temperatures encountered.

The problem was overcome when hard soldered joints were substituted for the 50-50 lead tin soldered joints.

Since the change to beta tin is slow, we should not expect notch brittleness and ductility tests to have predicted the failure encountered in the soldered copper joints described in Mr. Petty's article. We suggest that the substitution of hard soldered joints for soft soldered joints should cure this trouble.

W. J. MCBRIDE
L. N. PRESTON

Fullers' Earth Union, Ltd.
Surrey
England

DUCTILITY LOSS

To the Editor of Chem. & Met.:

Sir:—Thanks for sending me a copy of the letter from Messrs. McBride and Preston.

The phenomenon of "tin disease" actually occurs at temperatures as high as 18 deg. C. and the change has been found to be most rapid at —48 deg. C. This is in the commercially pure state.

It is known, however, that in the case of tin solders in high level refrigeration work, 50-50 solder has performed satisfactorily over indefinite periods of time.

The main difficulty in low level refrigeration work, if failure is encountered, is due

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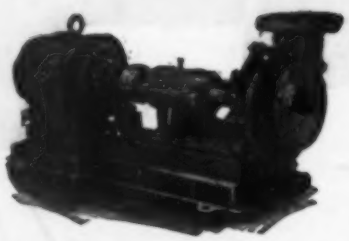

whether it is the pumping of chemicals . . . abrasive mixtures . . . clear waters . . . pulpy mixtures . . .

But whatever use . . . a Frederick pump is designed and guaranteed to meet the conditions under which your pump must work.

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Republic ENDURO Stainless Steel—the metal that's clean and as easy to clean as glass—is the ideal material for textile processing equipment.

With ENDURO equipment, you can switch from dark to light shades without tedious scrubbing or boiling out of the dyeing vat. A simple flushing with warm water followed by wiping removes all trace of former color in a hurry . . . eliminates danger of color contamination from the preceding batch and assures true color.

And there is no need to worry either about the smooth, lustrous surface wearing away. Republic ENDURO is solid stainless steel throughout.

For immediate and effective savings in both replacement and maintenance costs, specify Republic ENDURO Stainless Steel for all future dyeing, bleaching and other textile equipment.

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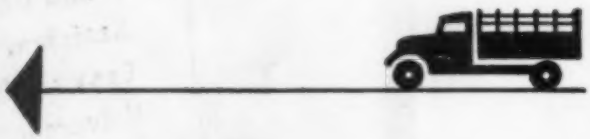
Is the capacity of your extinguishers large enough to do the job?

For This Light Truck a Quart Size Pyrene is Ample Protection.



But For This Heavy Trailer At Least a Gallon Pyrene Pressure type Extinguisher Should be Ready to Use.

Yesterday, the fire equipment in your plant may have been ample. But today increased areas, added hazards and the rush of production might cause a small fire to leap to disastrous proportions. Isn't it reasonable to suggest re-checking your fire equipment. Perhaps you should have more one quart Pyrene Vaporizing Liquid Extinguishers strategically placed, or if you now use oil, gasoline, highly volatile chemicals, dip tanks or spray booth, a heavy duty 2 quart or one gallon Pyrene Pressure type vaporizing extinguisher may be indicated. Don't take a chance with insufficient fire equipment now or ever. Call in the nearest Pyrene Jobber to help you with your fire hazard problem. Or write Pyrene for name of jobbers. No obligation, of course.

Standardize on Reliable Equipment by Pyrene.

***By the way:* When did you last test the fire extinguishers in your home?**

Pyrene Manufacturing Company

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to loss of ductility at operating temperature and consequent failure by vibration or shock.

PAUL BEAL PETTY

Hydrocarbon Research
New York, N. Y.

SIGNIFICANT CONTRIBUTION

To the Editor of Chem. & Met.:

Sir:—Congratulations to whoever was responsible for your courageous July feature article entitled "Accidents by Any Other Name." As you would expect, this article has caused considerable comment. The main question arising in some minds is "Yes, it's all too true but what should be done?"

How about a sequel? There are a lot of things that can be done, and *Chem. & Met.* can be in the forefront here in suggesting ways and means. Even your competitors might reprint it—as a very significant contribution.

C. J. KRISTER

Associate Editor
The Hexagon

RECOMMENDATIONS WANTED

To the Editor of Chem. & Met.:

Sir:—The article in July *Chem. & Met.* on the "accidents" in the Mythical Chemical Company by the not so mythical Henry Ross involves some fundamental weaknesses of our accelerated industrial age. Perhaps Mr. Ross will tell us what the president of the Mythical Chemical Company should do towards correcting the condition around which the story was built.

Can it be that applied psychology must be developed more rapidly to keep pace with the "hard" sciences? Is preventional psychiatry now being used successfully at the Graustark Division? Are Johnson-O'Connor tests fitting the round pegs into the round holes? And if so, how are the hollow circles kept out—they also fit a round hole.

Mr. Ross has written his report; what are his recommendations?

S. B. SEELEY

Director
Research and Technical Division
Joseph Dixon Crucible Co.
Jersey City, N. J.

REPRINTS REQUESTED

To the Editor of Chem. & Met.:

Sir:—I would like to secure three reprints of the article "Accidents by Any Other Name" which appeared in your July issue. I found this to be a very interesting and thought-provoking article.

R. F. MERRILL

Superintendent
The Andrew Jergens Co., Ltd.
Perth, Ontario, Canada

REPRINTS AVAILABLE

Editor's Note: Reprints of "Accidents by Any Other Name" are available and single copies will be sent gratis upon request. In quantities, the prices are $1 per dozen or $5 per hundred.

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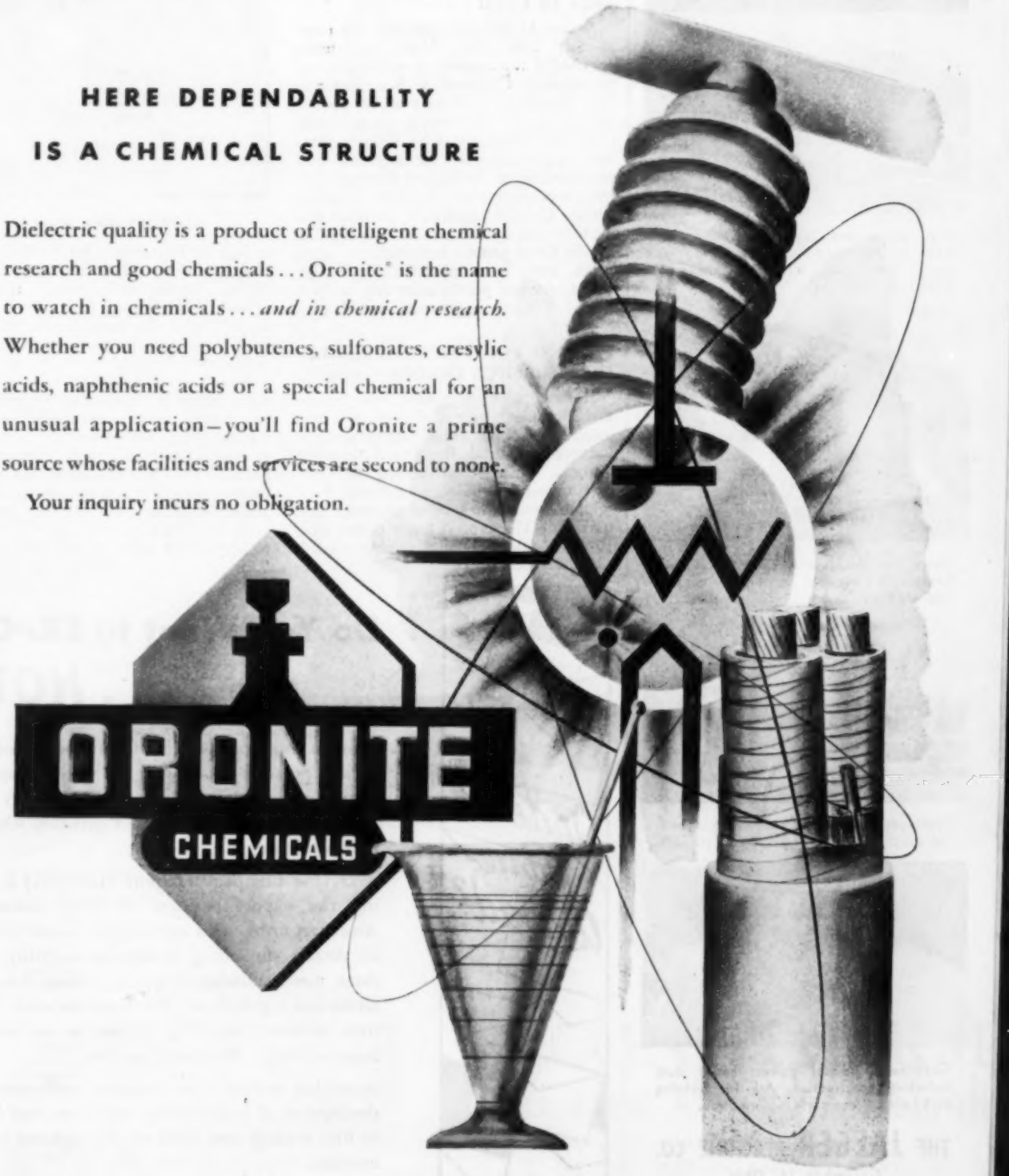

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TRENDS • EVENTS • DEVELOPMENTS

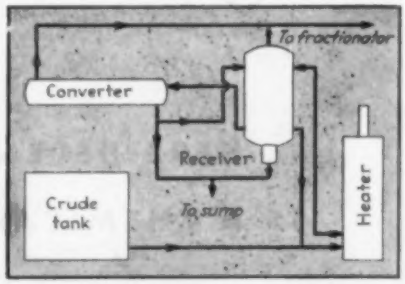
JOHN R. CALLAHAM, Pacific Coast Editor, San Francisco, Calif.

NEW SULPHURIC ACID UNIT IN UTAH

A NEW $1,000,000 sulphuric acid plant at Salt Lake City, Utah, was being operated at top capacity in mid-September by Garfield Chemical & Manufacturing Co. Producing 150 tons of 98 percent acid a day, the plant supplements output from the company's older 100-ton plant and supplys most of the sulphuric acid requirements of the Simplot Fertilizer Co. new superphosphate plant at Pocatello, Idaho. Garfield Chemical's increased production capacity also enables sale to other Pacific Coast process industries, including paper, steel, borax processors, and high-octane gasoline plants, according to William J. O'Connor, company president.

PROCESS FOR UTILIZING HEAVY HIGH-SULPHUR CRUDES

A NEW patented process, now beyond the pilot plant stage and ready for commercial use, has been announced by Records Industrial Research Laboratory, Tacoma, Wash., for converting this country's tremendous reserves of heavy, high-sulphur crudes into gasoline and other light fractions. The process treats crudes from 10 to 20 gravity and a sulphur content



Desulphurizing process

as high as 6 percent. An excellent yield of commercially valuable light fractions is claimed, together with a sulphur reduction down to 0.06 percent. Although all crudes do not react the same and a technique must be devised for each type, the plant design would remain essentially the same.

Results of the process are said to depend upon unique features in the oil preheater, oil converter and in a new method of applying the energy for conversion. Formation of coke is minimized, thus increasing light fractions yield and promoting longer continuous runs and more economical operations. Working and conversion temperatures have been reduced to 600-750 deg. F., depending upon the oil. The process

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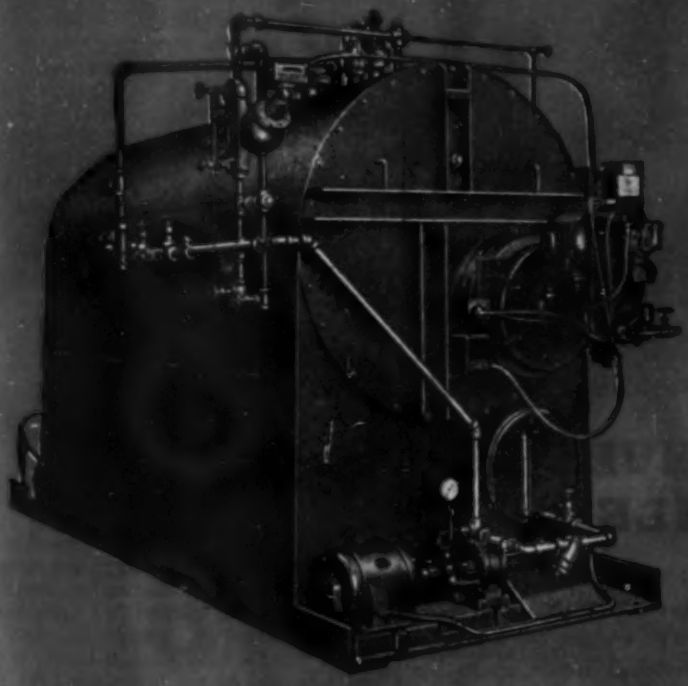

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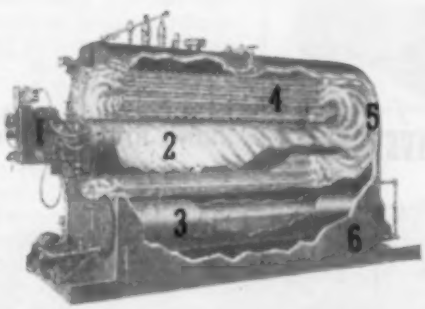

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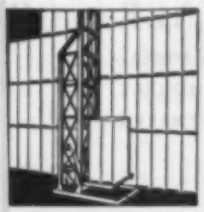
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ATOMIC PLANT CONTINUES AT FULL CAPACITY

CONTINUING to operate at full capacity, the Hanford Engineer Works at Richland, Wash., is turning out plutonium at essentially the same rate as when Japan surrendered, stated Col. Franklin T. Matthias, commanding officer during mid-September. At that time, no interruption in full-blast operations was expected. Furthermore, stated Col. Matthias, it would be hard to conceive of the Hanford plant being used for any other purpose other than for atomic force work and the production of plutonium. It had previously been rumored that the plant could be used for production of nylon and plastics.

Discussing the atomic bomb itself, Col. Matthias stated that the bomb's basic materials are innocuous, insofar as explosion is concerned, until the elements are brought together for the specific purpose of causing an explosion. Heat from the cooling operation "actually raised the temperature of the Columbia river 0.5 deg." Although the atomic bomb is based on the direct conversion of mass to energy, only about one thousandth of the plutonium mass involved is actually capable of being transmitted into energy. During production of plutonium, he stated, remote control is used and no individual sees directly any material during at least 24 consecutive stages of its production.

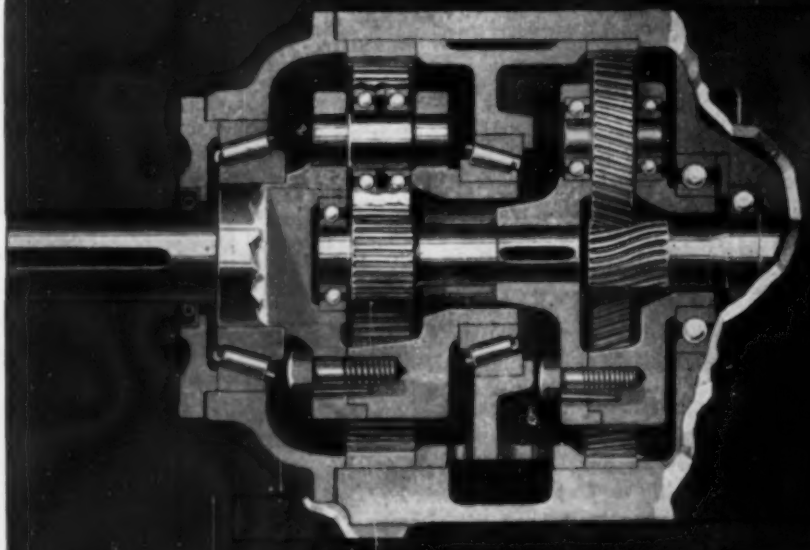
PENICILLIN PRODUCER INCREASES PLANT CAPACITY

LARGE-SCALE production of penicillin by the deep fermentation method was recently begun by Cutter Laboratories, Berkeley, Calif., since this method had been found to yield larger amounts of the drug in about half the time required by the bottle method used by the firm since 1943. As a result of the conversion, capacity of the plant is now some 10-fold greater than previously. Yields, it is claimed, are greater than anticipated. Cutter Laboratories, only producer of penicillin west of the Mississippi River, now becomes one of the 11 plants producing by submerged fermentation out of the total of 21 penicillin producers in the United States and Canada. This Berkeley plant was the first in the country to install an improved solvent extraction process which improves the yield of high-purity product.

LARGE ASPHALT REFINERY BEING BUILT IN PORTLAND

AN ASPHALT refinery costing more than $1,000,000 will be built on a 10-acre site at Willbridge, Ore., six miles northwest of Portland, by the California Asphalt Corp., a newly formed subsidiary of Standard of California, it was recently announced. Construction of the plant, the only asphalt refinery on the Northwest Pacific Coast, will start within 30 days. A complete operating unit in itself, the refinery will manufacture asphalt from heavy crude oil shipped in tankers from California oil fields. Capacity of the installation will be between 4,000

NO OVERHUNG PARTS



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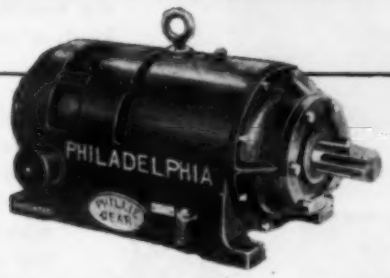

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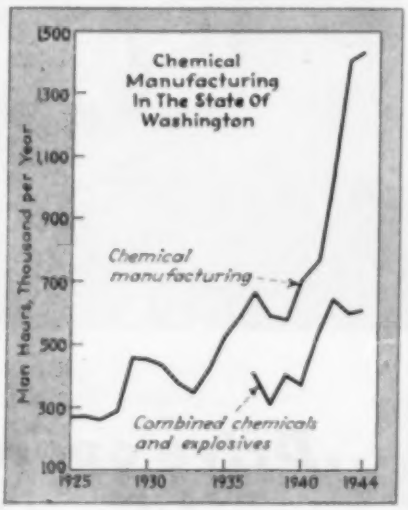
WASHINGTON CHEMICAL GROWTH CONTINUES UPWARD

GROWTH of chemical manufacturing in the state of Washington, as measured by yearly manhours of workers covered by the Workmen's Compensation Act, has been steadily upward since 1933, according to statistics released by the Department of Conservation and Development, Olympia, Wash. Manhours in this industry during 1944 amounted to 1,439,905 or 141 per-

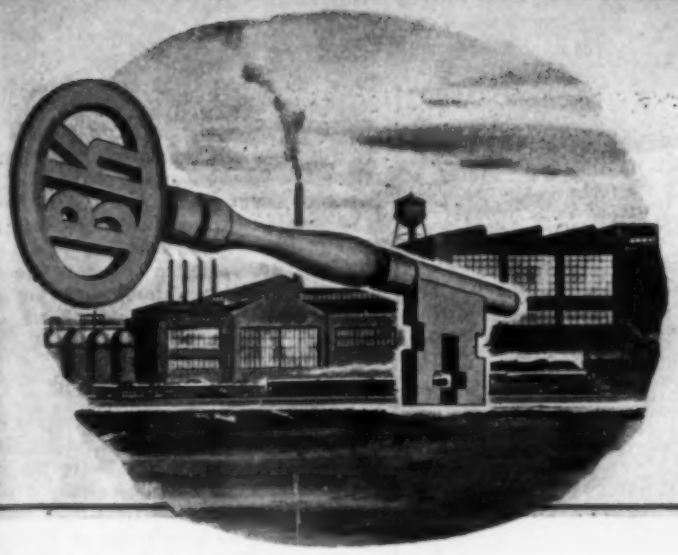


cent more than during 1939 and 510 percent more than during 1924. The accompanying chart shows manhours in chemical manufacturing as well as in combined chemicals and explosives plants.

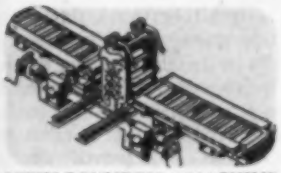
VOLCANIC ROCK PROCESSED INTO BUILDING MATERIAL

AFTER five years of research, a heating process has been developed whereby perlite volcanic rock can be "popped" into a form suitable for use as a building material, according to Continental Engineering Service, Chula Vista, Calif. A new plant to produce the material, known as Calite, will be erected in Chula Vista and will cost in the vicinity of $100,000. It is expected that the plant will be in operation soon, employing over 500 workers. Perlite for the operation will be mined near Las Vagas, Nev.

Holders of patents on the process, in addition to the Nevada mining firm, is the Calite Corp., recently incorporated in Nevada for $495,000. Continental Engineering Service in Chula Vista has been licensed to produce the patented retorts and other equipment as well as to produce the finished product. President and owner of Continental Engineering Service is Otto



The Key Called "KNOW-HOW!"



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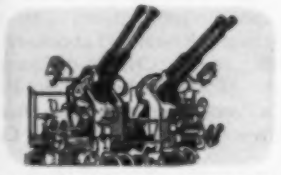
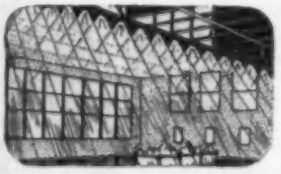


MARTINS FERRY and SPECIAL ORDNANCE DIVISIONS . . . 40 mm anti-aircraft gun mounts and mechanisms.



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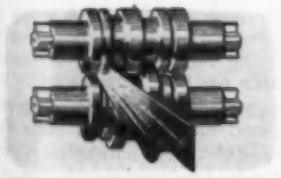

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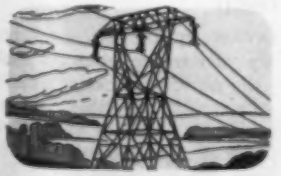

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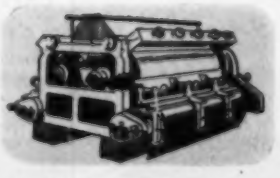

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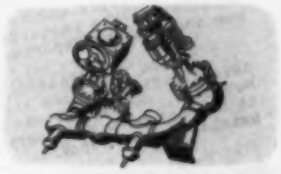

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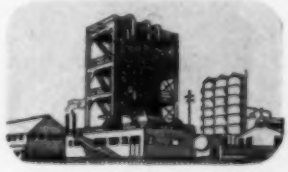

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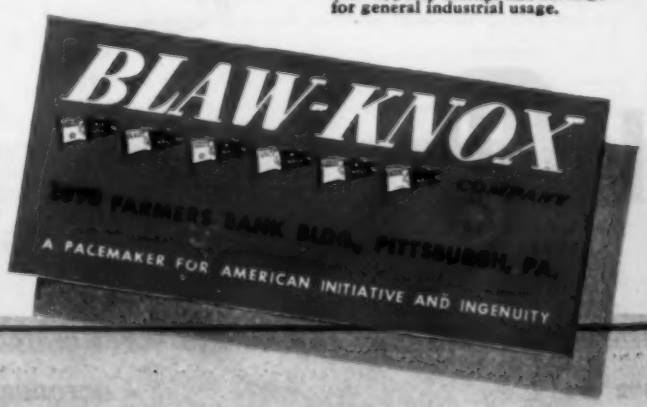

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SUBTILIN PROVES TO BE TUBERCULOSIS ANTIBIOTIC

SUBTILIN, an antibiotic which works on a principal similar to that of penicillin, has been found to be deadly to the organism which causes tuberculosis, it was announced by Dr. Anthony J. Salle, associate professor of bacteriology at the University of California in Los Angeles. Experiments in test tubes have shown that subtilin, while scarcely toxic to living tissue, is deadly in its effect on the tubercle bacillus. It has not yet been tested for effectiveness against the disease in animals or humans. Extracted from *Bacillus subtilis*, subtilin has also proved effective against other bacteria, including streptococcus, staphylococcus, pneumococcus and gonococcus, in test-tube experiments.

Research has been conducted for the past seven months cooperatively with the Western Regional Research Laboratory at Albany, Calif., and the division of pharmacology of the Medical School at the University of California, Berkeley. The project is being financed by Eli Lilly and Co., Indianapolis.

ATOM BOMB RESEARCH AT UNIVERSITY OF CALIFORNIA

UNIVERSITY OF CALIFORNIA men have played a prominent part in working out the two principal tasks involved in the manufacture of the atomic bomb, according to reports. The electromagnetic method of making the isotope of uranium, U-235, used in the plant in Tennessee to produce material for the bomb was developed by a group of scientific men under Dr. Ernest O. Lawrence at Berkeley. Dr. J. R. Oppenheimer, another University of California professor, headed a group of scientists who manufactured the bombs, the work being conducted first at Berkeley and later at Los Altamos, N. M. Before the war, the two new elements neptunium and plutonium had been discovered by University scientists in the products of Dr. Lawrence's cyclotron.

ALCOA'S TROUTDALE UNIT CLOSED

CANCELLATION by the Reconstruction Finance Corp. of wartime leases on plants operated by the Aluminum Co. of America caused the closing down of three potlines at the company's Troutdale, Ore., plant early in September. Fourth potline at the plant has been idle for some time. The cancellation does not affect Alcoa's privately-owned plant at Vancouver, Wash., where arrangements recently were completed with Bonneville Power Administration for power sufficient to operate a fifth production unit. Although the RFC announcement terminating the leases said

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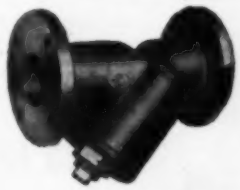

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F-160A1; Butt-weld, 150 lbs. pressures

F-160A3; Threaded, 150 lbs. pressures

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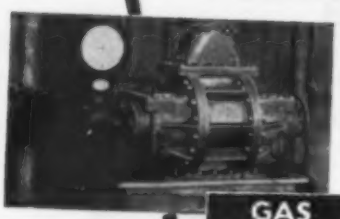
Measure AIR · GAS · LIQUID With Extreme Accuracy

HOT TAR



GAS

JUICES

WATER

OIL

Roots - Connersville Rotary Positive Displacement Meters are simple in design and of rugged, all-metal construction. The volume displaced each revolution of the impellers has been determined accurately for each size meter. This volume is fixed and unchangeable.

PERMANENTLY ACCURATE

This unchanging displacement means that the extreme accuracy of "R-C" Meters is PERMANENT. There are no valves, orifices, springs, buckets, diaphragms, or other light metal parts to wear or deteriorate and destroy the accuracy of measurement. Whether handling air, gas or liquid, the accuracy of "R-C" Meters is the same. Recorders can be furnished for direct reading in cubic feet, gallons, or any desired unit. Photos show just a few of the many applications for which Roots-Connersville Meters are regularly used.

OTHER IMPORTANT FEATURES

1. Accuracy maintained despite changes in moisture, specific gravity, or temperature of air or gas.
2. Variations in rate of flow from 5% to 150% of normal capacity do not affect accuracy.
3. Large capacity combined with compact size.
4. Negligible pressure absorption.
5. The longer life, minimum attention and maintenance requirements, and greater accuracy of "R-C" Rotary Positive Displacement Meters repay their cost many times over.

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ONE OF THE DRESSER INDUSTRIES
510 Illinois Avenue Connersville, Indiana

WRITE FOR THESE BULLETINS
LIQUID METERS..... NO. 40-B-15
AIR & GAS METERS.... NO. 60-B-13

Roots CONNERSVILLE SINCE 1854
Rotary Positive AIR GAS LIQUID Meters

its purpose was to dispose of the plants in a manner which would create competition in the industry, Alcoa hopes to retain the Troutdale plant. Arthur P. Hall, chairman of the company's committee on postwar facilities and development, termed the unit "one of the most economical of the Alcoa-operated plants."

While Alcoa has no operation rights in its lease, this does not prevent the company from bidding on the plant when it is offered for sale. The Reynolds Metal Co. made a bid for the plant Aug. 21, 1945. Reynolds controls 10 percent of the nation's aluminum production facilities, compared with the government's 52 percent and Alcoa's 38 percent. The Reynolds bid offered to operate the Troutdale plant for half what the government was charged by Alcoa on a lease which would give an option to buy the installation.

SPRINGFIELD ALCOHOL PLANT TO BE COMPLETED

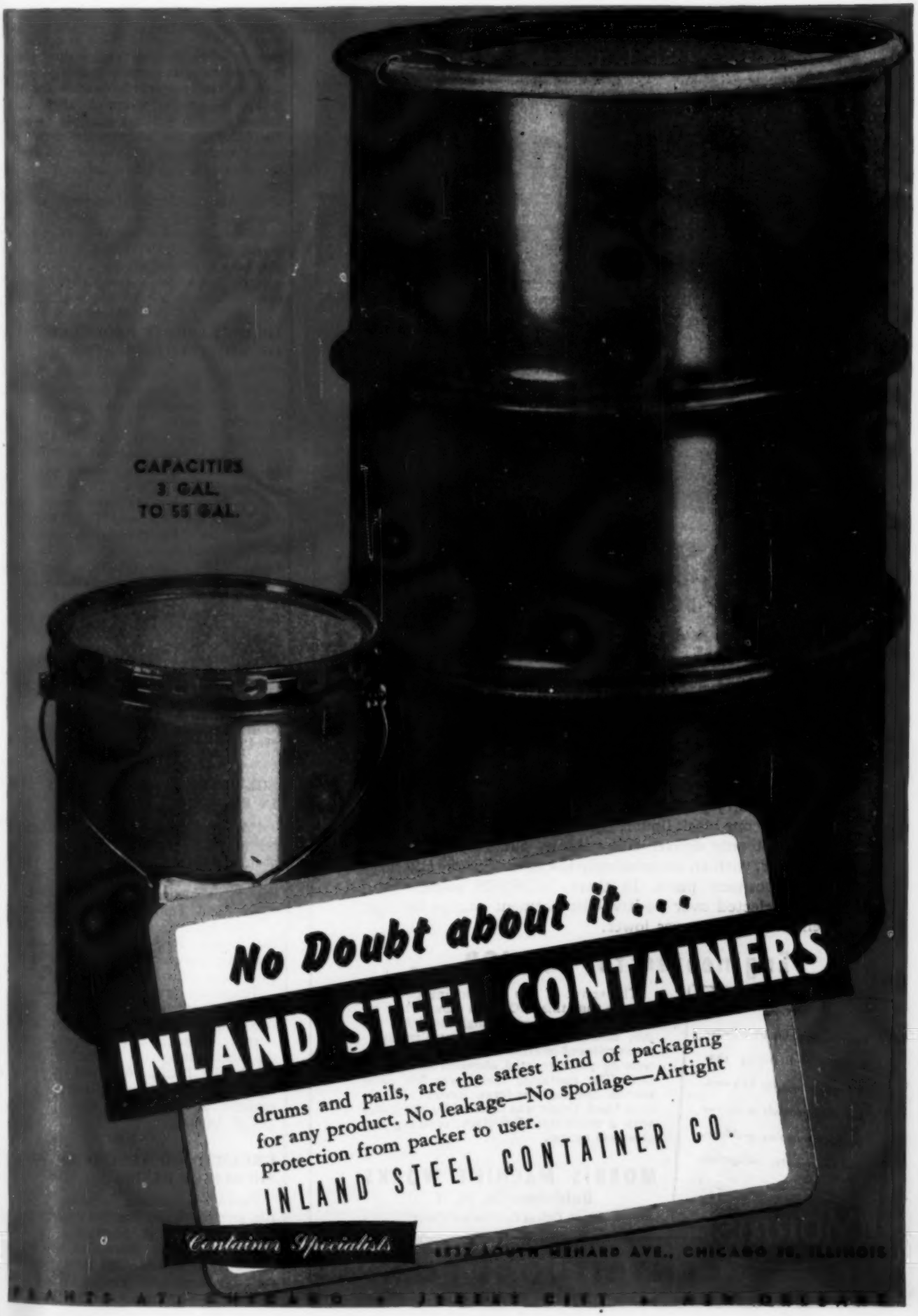
MEMBERS of the Oregon congressional delegation have been assured by Secretary of Agriculture Anderson that the wood waste chemical manufacturing plant at Springfield, Ore., will be completed as a federal forest program. Construction of the plant was stopped recently under the blanket order halting work on war projects of all kinds. Secretary Anderson plans to have the project, which was being built by the War Plants Corp., transferred to the jurisdiction of his department. The plant will be operated by the Willamette Valley Wood Chemical Co., headed by a group of Oregon lumbermen, and will produce alcohol by an improved hydrolysis process. Lignin will be an important by-product.

EQUIPMENT FIRM PLANS BIG EXPANSION

EXPANSION of facilities for manufacturing pumps for west coast industry is underway by the Byron Jackson Co., Los Angeles, Calif., with over $1,000,000 being spent on buildings and equipment at the company's Vernon, Calif., plant, according to Floyd Merritt, vice president in charge of construction. Added facilities will be used principally for making centrifugal pumps for the oil industry and general industrial use, boiler feed units and pumps for agricultural, mining and municipal use. Construction of 75,000 sq. ft. of machine shop area, a pattern shop and storage buildings is expected to begin in December. The firm also plans to begin construction of a $150,000 addition to its Houston, Tex., plant in October to double capacity for oil tool manufacture and pump repair.

PACIFIC RESEARCH FOUNDATION ORGANIZED

FIRST of its kind on the west coast, the Pacific Research Foundation, a non-profit organization to provide independent research facilities for aiding the west's industrial expansion, was incorporated recently in Los Angeles, Calif. The organization plans to offer services in the fields of chemistry, metallurgy, ceramics, bacteriology, electronics, petroleum, mining,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for any product. No leakage—No spoilage—Airtight
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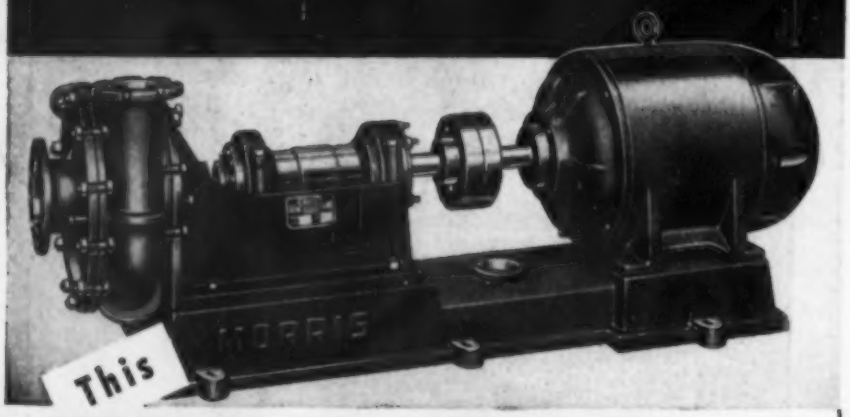
With a Viscosity of 7420 SSU at 150° F



MORRIS TYPE "S"

CENTRIFUGAL SLURRY PUMP...

gave longer service with fewer replacements than positive displacement pumps

● Viscosities of this range are normally considered "impossible" for centrifugal pumps. But the recovery plant of a large Virginia paper mill discovered that a MORRIS type "S" slurry pump would deliver 500 gallons per minute of this viscous black liquor, against a 75-foot total dynamic head. Not only deliver this volume, but keep it up year after year, with an astonishingly low rate of wear and need for replacement parts. In short, MORRIS pumps were finally selected over positive-displacement pumps because their over-all cost was lower.

Engineered for the JOB...

★

Morris engineers have been building outstanding centrifugal pumps for 81 years. Let them consult with you on your pumping problems. No charge. No obligation.

The secret of this outstanding performance is that this MORRIS pump—like all MORRIS pumps—was engineered for the job. Extra wide shell and impeller clearances reduced internal friction. Extra heavy wearing parts resisted abrasion and corrosion. The operating speed was low. The suction opening was large. Result: the viscous black liquor was handled by the pump with a minimum of friction, scouring and chemical action.

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MORRIS CENTRIFUGAL PUMPS

agriculture, mechanical and structural research. With hopes of being in operation early in 1946, the new organization plans to be endowed to provide buildings, property and equipment. Spokesmen for the group, which is patterned after well-known research facilities available to eastern industries for many years, claim research costs on a given project will be less than in a privately-maintained laboratory.

Dr. Maurice Nelles, Lockheed Aircraft engineering and research specialist and chief consultant for the War Production Board, Morlan A. Visel and E. L. Black, also from Lockheed's research department, are responsible for forming the Foundation.

IDAHO LARGEST PRODUCER OF WHITE POTATO STARCH

More than 50 percent of the white potato starch consumed in the United States now comes from four locally-owned companies, all established since 1941, in the Snake River Valley of southern Idaho. These plants have produced over 22,000 tons of starch, valued in excess of $2,000,000, from more than 175,000 tons of cull potatoes that otherwise might only have been used for stock feed. Demand for the starch has thus far exceeded the supply. Production, beginning late in October 1941, amounted to some 2,400 tons during 1941-42 as compared to over 10,000 tons made during 1943-44 by the three principal producers. Production by plants has been as follows:

	Location	Tons Produced 1943-44*
Idaho Potato Starch Co.	Blackfoot	4,400
Magic Valley Processing Co.	Twin Falls	3,500
St. Anthony Starch Co.	St. Anthony	2,280

*The firm at Menan delivers wet starch to St. Anthony Starch Co. for processing, drying and marketing.

COLUMBIA METALS INTERESTED IN REDUCTION UNITS

Columbia Metals Corp., which is building a $5,000,000 alumina-from-clay plant at Salem, Ore., has offered to lease for five years the government-owned aluminum reduction plants at Spokane, Wash., and Troutdale, Ore. The rental proposal has been submitted to DPC and the Surplus Property Board, James O. Gallagher, president of the northwest corporation reported.

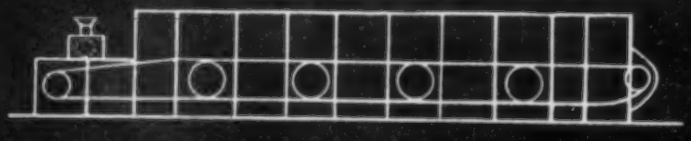
Temporary leasing and ultimate acquisition through purchase of the Troutdale and Spokane reduction plants will serve as a nucleus for development of a completely integrated operation centering in the Pacific Northwest, Mr. Gallagher said. The two plants are now operated under lease by the Aluminum Co. of America.

GREASEWOOD TESTED AS SOURCE OF RESINS

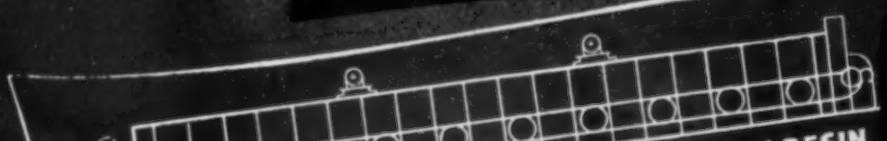
Desert greasewood, sometimes called the creosote bush, has been undergoing tests as a source of industrial resins in a project under the supervision of WPB, according to reports. The actual research work has largely been done by Dr. William E. Martin, formerly of the University of

PROCTOR DRYERS

designed for PLASTICS



CONVEYOR DRYER FOR CASEIN



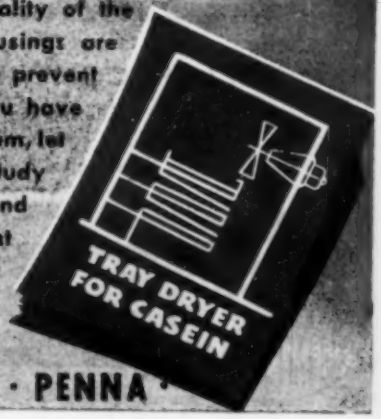
CONVEYOR DRYER WITH ROTARY FEED FOR SYNTHETIC RESIN

SINGLE CONVEYOR DRYER WITH SPECIAL AUTOMATIC FEED FOR SYNTHETIC RESIN

... meet manufacturers' individual capacity requirements ... assure controlled drying

The importance of CONTROLLED DRYING in plastics manufacture cannot be over emphasized. Plastics, subjected to too high temperatures or subjected to lower temperatures for too long a time, during the manufacturing stage, are not well adapted to further processing. Proctor engineers have designed many dryers for use in the drying of urea-formaldehyde, casein and soya bean plastics. In each case, the dryer has been designed so that it is possible to control drying time and temperatures to meet the specific requirements of particular plastic being dried.

When drying is done in a continuous conveyor dryer, the speed of the conveyor can be regulated. Temperatures throughout the entire drying process are carefully regulated and air-circulation is directed in the most effective manner. Automatic feeding devices have been developed to control the amount of material fed to the dryer at all times. The combination of these accurately controlled factors results in uniformly high quality of the finished plastics. Housings are designed and built to prevent escape of fumes. If you have a plastics drying problem, let Proctor engineers study your requirements and recommend an efficient dryer to meet your needs. Write today.



TRAY DRYER FOR CASEIN

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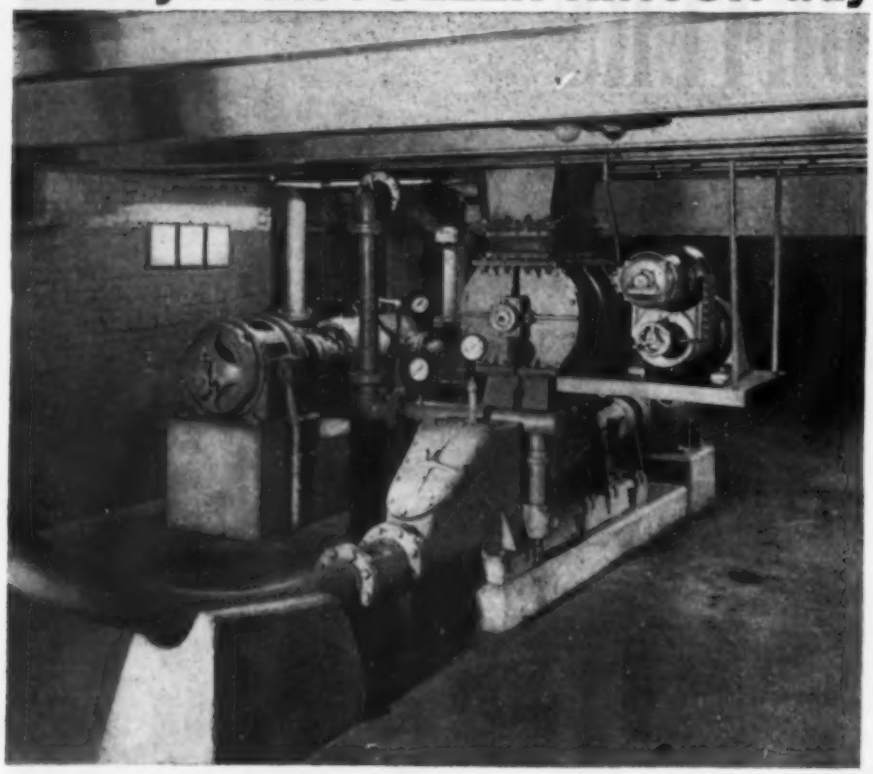
Convey... the FULLER-KINYON way



CLEAN, EFFICIENT TRANSPORTING OF DRY PULVERIZED MATERIALS

One of the leading producers of pulverized phosphate rock in the East has installed a Fuller-Kinyon Conveying System for transporting this material from a pulverizer to mixer bin, illustrated in the photograph above.

The pulverized phosphate rock is delivered by controlled feed through a Fuller Feeder to the Fuller-Kinyon Pump, which conveys this material approximately 150 feet to the mixer bin. Rate of conveying 10 to 25 tons per hour.

An interesting and important feature in connection with this installation is the use of a Fuller Rotary Single-stage Compressor, direct connected to the pump, which furnishes air for conveying at the rate of 406 c.f.m. at 15-lb. pressure . . . air where and when needed and at pressures to do the work most economically and efficiently.

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FULLER COMPANY

FULLER-KINYON, FULLER-FLUXO AND THE AIRVEYOR CONVEYING SYSTEMS ROTARY FEEDERS AND DISCHARGE GATES ROTARY AIR COMPRESSORS AND VACUUM PUMPS AIR-QUENCHING INCLINED GRATE COOLERS . . . DRY PULVERIZED MATERIAL COOLER AERATION UNITS . . . MATERIAL LEVEL INDICATORS MOTION SAFETY SWITCH SLURRY VALVES SAMPLERS

P-75

Arizona. A pilot plant was set up at the Arizona Fertilizer Co. in Phoenix and experimental work done on five tons of greasewood. Recovery of the resin was accomplished by several acid and alkaline precipitation processes, giving different forms of products. The extraction process, it was reported, has been considered successful and the resins are now being studied by various industrial users to determine their potenial applications. Future use, Dr. Martin says, depends on whether they can be produced at a competitive price as well as on the outcome of present uses tests.

Greasewood is already the source of nordihydroguiaretic acid (NDGA), a potent anti-oxidant against rancidity in foods. William J. Strange Co. of Chicago is reported to be producing NDGA on an industrial scale.

STEEL PLANT ADDITION PLANNED

A NEW $100,000 steel plant addition to the W. R. Ames Co., San Francisco, will be erected as soon as materials are available, it was announced by Cloyd Gray, president. Facilities will be increased for quantity production of metal products with continuous painting equipment for all types of metal items.

MODERN TREATMENT PLANT FOR SAN DIEGO

A NEW water filter plant costing $1,800,000 and designed to purify water by the lime-zeolite process will be constructed at San Diego, Calif., it was announced recently. The new plant will treat the city's present water supply in addition to Colorado River water to be carried through an aqueduct under construction. The plant, to allow ultimate treatment of 100,000,000 gal. of water per day, will be patterned after one located at La Verne, Calif., reputed to be probably the most modern in the world.

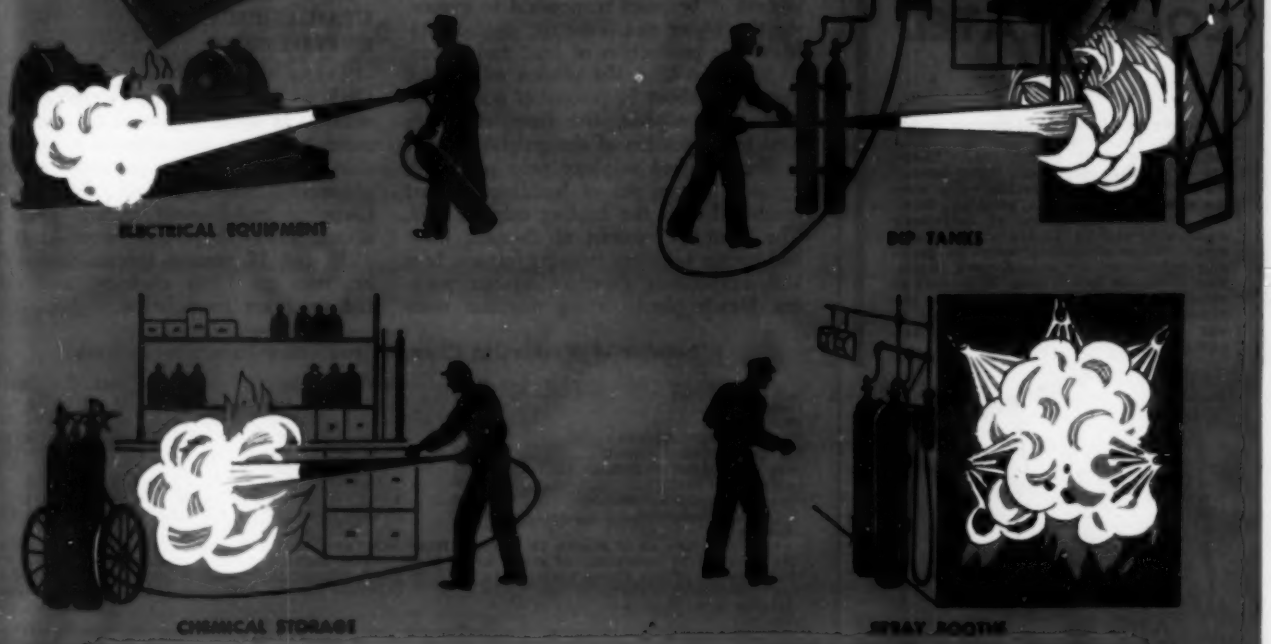
WEYERHAEUSER LAUNCHES IMPROVEMENT PROGRAM

A PROGRAM of expansion and improvement which will double the present capacity of the plant will be undertaken at once by the Pulp Division of Weyerhaeuser Timber Co. at Longview, Wash., according to J. P. Weyerhaeuser, Jr., executive vice president. The program consists of converting the 90,000-ton bleached sulphite plant to an entirely new magnesia process, adding a new sulphate plant with an annual capacity of 70,000 tons of bleached pulp, constructing a new steam and power generating unit, and installing two hydraulic log barkers. Most significant are the steps forward in wood conservation: (1) The sulphite mill will continue to turn out its present tonnage, but with 15 percent less wood, and in addition will provide its own steam and power requirements; (2) the new sulphate mill will turn out 70,000 tons of pulp annually and supply much of its own steam and power without any enlargement of present areas being logged, this being the result of improved wood utilization in forestry, logging and milling.

The present bleached sulphite pulp mill

C-O-TWO FIRE-KILLERS

as modern as tomorrow



Modern production methods operating in high gear with 'round-the-clock protection against interruption or damage by fire . . . that's modern industry teamed up with modern fire protection! C-O-TWO fire extinguishing systems stand ready for instantaneous attack on fires, killing them on the spot with dry non-damaging, non-conduction sub-zero carbon dioxide gas. Plant hazards cease being potential danger spots and constant fire threats when men of vision protect lives and property with C-O-TWO equipment. Hand portables with the famous Squeez-Grip valve, fast mobile wheeled units, hose reel and built-in systems of the pressure operated type all engineered to give industry modern fire protection. Our Army, Navy and Maritime Commission are large users of C-O-TWO carbon dioxide fire extinguishing equipment which is also listed and approved by Underwriters' Laboratories and Factory Mutuals. C-O-TWO is fast, easy to operate, safe, non-deteriorating and causes no damage to materials or equipment during or after its operation. Write for information.

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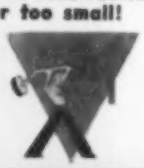

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will be converted from a lime to a magnesia process with no change in capacity or type of pulp produced. The new process, first commercial installation of its kind, will improve plant efficiency in two ways: (1) Conversion of organic materials in the waste liquor into steam and power; (2) recovery of the principal basic chemicals. Waste resulting from sulphite pulping contains approximately 50 percent by weight of the raw wood entering manufacture. By converting to the magnesia process, it becomes economical to evaporate the liquor and burn the organic materials for production of heat and power. At the same time, the process will permit recovery of about 90 percent of magnesium oxide and sulphur, the basic chemicals used in production of the pulping acid.

The bleached sulphate pulp plant will comprise a new set of buildings in part combined with the existing sulphite mill. The plant will consist of chipping plant and storage facilities, recovery furnace, lime kiln, evaporators, digesters, screens, washers, bleach plant, drying machine room and warehouse. Refinements in wood utilization in Longview operations are expected to yield from current wastes the entire supply of wood needed for the 70,000 tons of pulp to be manufactured by this new unit annually. The new power house will consist of an integrated boiler unit, one-half of which will utilize waste liquor from the converted sulphite mill while the other half will utilize liquor from the new sulphate mill.

UTAH CHEMICAL EMPLOYMENT

TREND of the chemical industries in Utah, as revealed by the average monthly number of workers covered by unemployment insurance, was recently made available by the Utah Department of Employment Security, Salt Lake City. Chemical employment during 1944 averaged some 31 percent more than for 1939 and 38 percent greater than 1938. Statistics on Utah chemical and other industries are given below.

Number of Workers in Chemical and Other Industries in Utah

	1939	1940	1941	1942	1943	1944[1]
Construction	4,443	4,281	9,513	21,884	21,632	8,732
Manufacturing	16,025	17,691	19,793	29,702	33,091	24,328
Food and kindred products	6,730	7,289	7,969	8,539	8,203	8,183
Chemicals and allied products	544	604	774	9,082[2]	10,947[3]	713
Petroleum and coal products	363	528	500	652	754[3]	919[3]
Iron and steel products	1,325	1,404	1,551	1,873	2,468[4]	3,144[4]
Non-ferrous metals and products	2,650	3,026	3,508	3,526	3,417	3,012
Total, all industries	73,332	80,853	91,297	116,639	122,810	99,975

[1] Preliminary as of March 19, 1945. [2] High level of chemical manufacturing during 1942 and 1943 caused by operation of small arms plant. The highest number of chemical firms during any quarter of the above period was 33. [3] Increase during 1943 and 1944 from operation of new high-octane fuel plant in Salt Lake City. [4] Increase during 1943 and 1944 from operation of Geneva Steel Works.

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and here's why!

BUMP Industrial Pumps will handle light or viscous liquids with positive displacement at any speed or pressure. They are self-priming under high vacuums or against head pressures, and can be operated at slow speeds without agitation, churning, or vibration within the pump. Bump Industrial Pumps deliver a constant volume per revolution regardless of speed or pressure, and because of their special design, operate at the lowest maintenance cost. As one company that has used a large number of Bump Pumps for years states, "They do a better job at a lower total cost to us than any other pump now offered on the market". Note principle of operation above and you'll see why the low maintenance cost.

Available in capacities from ½ to 400 GPM and in different models and metals suitable to the job. Illustrated here is the industrial direct drive model. Complete new catalog upon request.

The BUMP PUMP CO. LA CROSSE WISCONSIN

Why you can be sure of higher CORROSION-RESISTANCE, positive NON-ABSORPTION *with* LAPP CHEMICAL PORCELAIN

1

LAPP *SPECIFIED* CLAYS ARE *NOT* FOUND IN "BACK DOOR" CLAY PITS...

LAPP has gone as far as necessary—even to England—to obtain carefully selected clays that meet rigid LAPP specifications for plasticity, impurity content, acidity and other important properties. And every carload is scientifically inspected at the plant before the clay goes into production.

2

THE SECRET OF *EXTRA* STRENGTH, *GENUINE* NON-POROSITY, IS THE LAPP VACUUM PROCESS . . .

LAPP Chemical Porcelain is made from liquid clay slip which passes through this vacuum chamber. Here all air, in bubbles and in solution, is boiled out. Subsequent operations are performed without incurring voids, laminations or blebs.

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THOROUGHLY VITRIFIED BODY PRODUCED IN THE LAPP *CONTINUOUS* KILN . . .

In LAPP'S 380-foot tunnel kiln temperatures exceeding 2250°F are scientifically controlled. The formed clay is slowly brought to the exact molten stage where *complete* vitrification occurs, fusing the clay body into *solid* Porcelain, chemically inert and well beyond the degree of vitrification found in ordinary ceramics.

You get all the "natural" advantages of ceramics *developed to their highest degree* when you install LAPP Chemical Porcelain. Complete corrosion-resistance to all acids (except HF), positive non-absorption, added mechanical strength are plus advantages of LAPP Chemical Porcelain. These are made possible by its *extra* dense, homogeneous, *thoroughly* vitrified body.

If you've had trouble with ceramics on a problem that ceramics should solve—it will pay you to experience the difference in LAPP Chemical Porcelain. *LAPP Insulator Co., Inc., Process Equipment Division, LeRoy, N. Y.*

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FOR MILITARY PURPOSES

By Henry DeWolf Smyth

Chairman, Dept. of Physics, Princeton University. Consultant to the "Manhattan District" (The cryptic title given to the Atomic Bomb project by the U. S. Corps of Engineers)

THIS is the famous "SMYTH REPORT" as issued by Dr. Smyth at the direction of Maj. Gen. L. R. Groves, in charge of the Atomic Bomb project. It is a general account of the development of atomic energy under the auspices of the United States government.

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NEWS FROM ABROAD

IMPROVEMENT IN SHIPPING AND SUDDEN TERMINATION OF LEND-LEASE AFFECT BRITISH FOREIGN TRADE

Special Correspondence

THE SURRENDER of Japan was followed by government pronouncements promising a speed-up of demobilization and large-scale manpower releases from British armament factories. Figures were given of the number of people expected to become available for civilian employment up to the end of this year, and a relaxation of the directive measures in the field of labor distribution was promised. The next few months should thus see a substantial switch-over from war to peacetime activities, but the change, it is now evident, will not be as marked and extensive as had been hoped. It is perhaps symptomatic that, by September, not a single commodity control office had been disbanded though there have been modifications and improvements in license requirements.

The change in the markets has been slight. A number of government contracts have no doubt been cancelled, though details cannot be obtained, and a number of government factories and other plants employed on war contracts have been released for reconstruction work. Mosquito aircraft factories are turning out plywood "utility" furniture, aircraft engine works are making motor car engines, electrical and engineering firms are resuming peacetime lines of production. In some plants reconversion has been short and simple, in others it is more complicated so that labor had to be stood off for a few months. Yet other plants have been closed until a new field of activity has been opened.

In the chemical industries the process of readjustment is partly delayed by uncertainty about the needs of industrial customers who are only now switching over. A policy of "wait and see" still determines the market for pharmaceutical and fine chemicals. Large sections of the chemical industry, like the fertilizer trade, are in no doubt however that capacity production will still be needed, and any kind of chemical product of use for building will be required in maximum amounts. The paint trade will thus be fully employed, and plastics makers expect good orders in this field.

Supplies for exports are now more plentiful in some sectors, like coal-tar products, but export restrictions still hamper resumed dealings with foreign customers who in part seem to be holding out for lower prices. Some wartime additions to export prices due to special insurance risks and shipping costs will soon be removed, but in general a return to anything like the pre-

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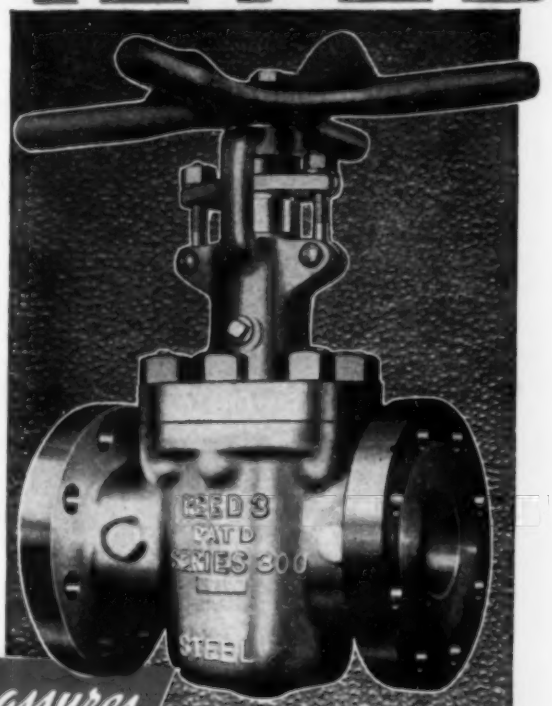
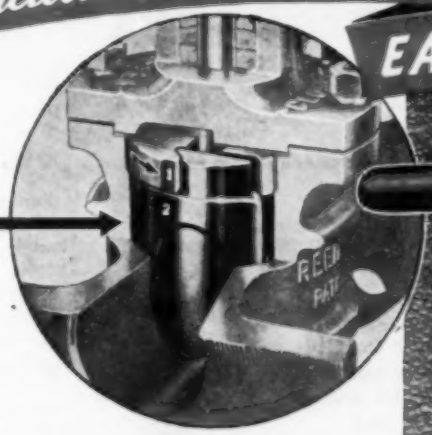


It's the lifting action of the disc that assures

EASE OF OPERATION



THE DISC (2) IS PULLED DIRECTLY AWAY FROM ITS SEAT BY THE OPENING LUG (1) BEFORE IT STARTS TO MOVE TO THE OPEN POSITION

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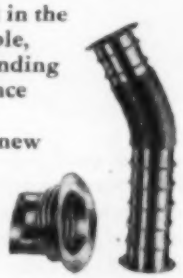

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war level seems out of the question. Considerable hopes are based on the gradual resumption of commerce with continental Europe for which the foundation is being laid by inter-governmental trade and payments agreements.

In the import trade in chemical raw materials and products the situation has been profoundly altered by the improvement of shipping and the sudden termination of lend-lease. What importance is attached to the ending of the lend-lease system of inter-Allied commerce in the chemical field is shown by the fact that during the past few years British chemical imports from U.S.A., mostly under lend-lease, approximated in value Britain's total prewar imports of chemicals from all sources. Admittedly these value figures are not strictly comparable because of the advance of prices in the meantime, but even so the wartime transformation of the scene is truly remarkable.

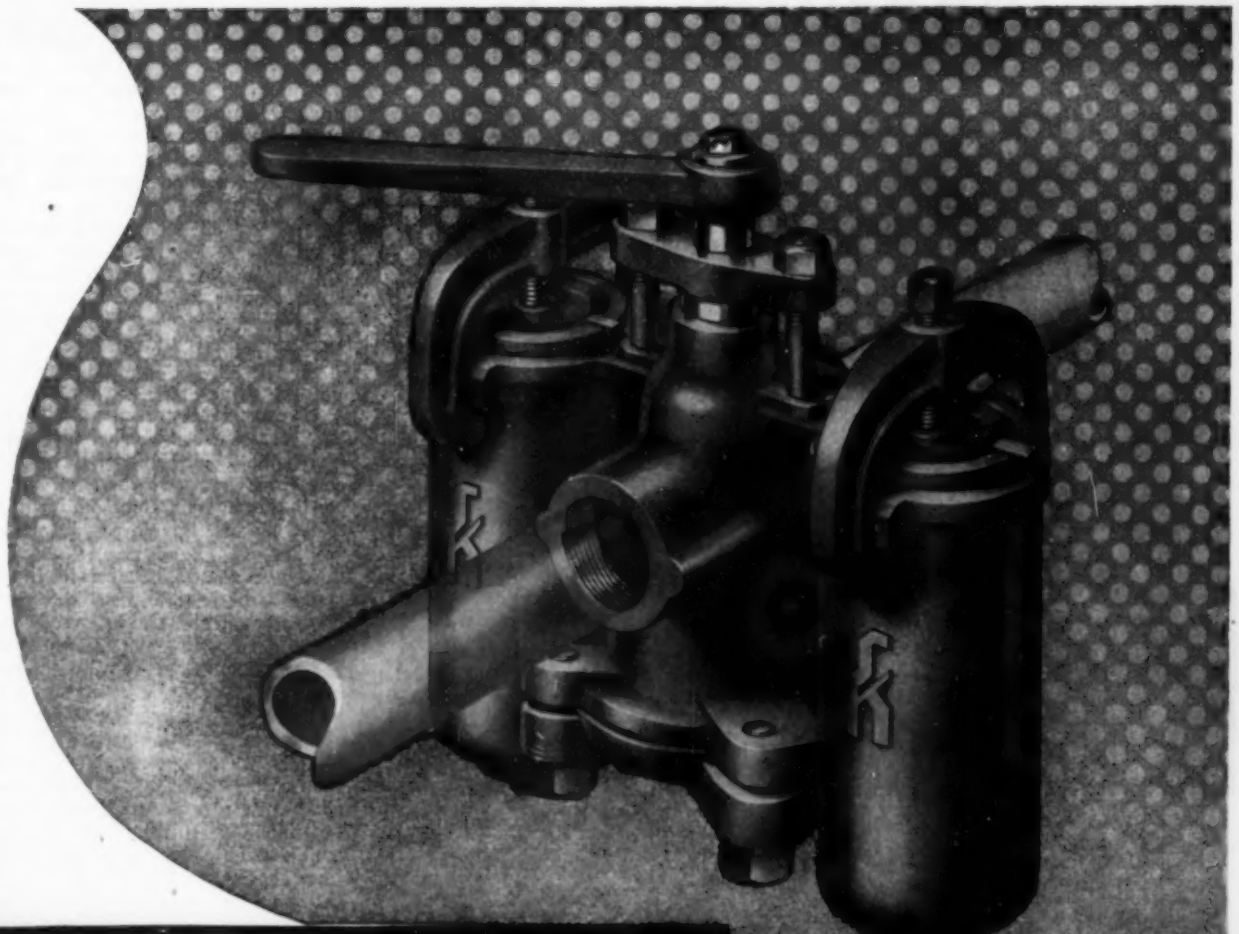
CHEMICAL IMPORTS

In 1939 British imports of chemical manufactures were £15,900,000 of which only a small part came from U.S.A. In 1944 the comparable figure was £25,100,000, and of this £13,000,000 came from U.S.A. Allowing for price changes during the past five years, it may be concluded from these figures that the over-all increase in British chemical imports was only small in volume though large in value, that it was entirely due to large receipts of lend-lease supplies from U.S.A., and that the ordinary trade in chemical products has not expanded but shrunk.

Nor is this surprising. Before the war Germany was the chief source of high-class chemicals, dyestuffs, etc. This source of imports, as well as other continental sources of chemical raw materials, was stopped by the war, and it was at least in part because of the need of replacing certain chemical materials that imports from U.S.A. rose to such vast dimensions. American phosphates took the place of African phosphates, German and French potash compounds were replaced by the U.S., Italian sulphur had to be replaced by Louisiana sulphur.

In some cases former imports of raw materials were replaced by semi-finished or finished products, as, e.g., molasses by industrial alcohol imports. Yet other classes of import commodities show the effect of combined direction of Allied raw material resources. The wartime expansion of British chemical imports in general and from U.S.A. in particular does not therefore reveal a long-term trend likely to be continued over the next few years. On the contrary, it is more likely that with the end of lend-lease Great Britain will return to its prewar sources of chemical imports. Not only did these sources prove to be the cheapest in the "normal" conditions prevailing before the war, but the deterioration of Britain's financial position will force her to favor imports from countries which provide markets for British export goods.

The chemical trade between U.S.A. and Great Britain before the war was of a limited nature as is only natural between two highly-industrialized countries. British chemical imports consisted largely of substances produced in U.S.A. and not available in the British Isles, like borax, bro-



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mine, potassium muriate, carbon black, essential oils, lubricating compounds, and phosphates. Others were imported from U.S.A. because the existence of certain mass production industries gives American producers an advantage over others; glycol ethers, insecticides, ointments, printers' inks. Varnishes belong to this group which cannot be separated clearly from the first one.

Great Britain also imported certain U. S. specialities, such as proprietary medicines and photo-chemicals, but in general continental Europe provided a cheaper source of this class of goods. Finally British imports from U.S.A. included certain quantities of products like acetone, benzol, sodium chromate and bichromate, which were available from various sources and were occasionally bought advantageously from U.S.A. The bulk of the British import trade in U. S. chemical and allied goods was in bulk commodities in which those producers enjoyed a preferential position.

So far as these are concerned, the British market is likely to rely on U. S. merchandise, although the war has speeded up the development of alternative sources abroad. For petroleum chemicals Britain may develop an internal source of supply by expanding her oil refining industry. For essential oils hopes are based on the African colonies where considerable progress has been made. In the field of chemical manufactures the war has witnessed considerable expansion of British home production, especially of chemicals previously bought from continental Europe, and this process will continue. Even if imported products were cheaper (and it is not suggested that British producing costs are exceptionally high), the home product would presumably be given preferential treatment if essential for industry or promising a substantial saving in foreign currency.

DROP IN DYESTUFFS

Imports of dyestuffs have shrunk to less than one-tenth the prewar figure, and while this was obtained, at least partly, by special economy in consumption, it is unlikely that the British market ever again will absorb as large quantities as before the war. Certain new basic industries, such as the calcium carbide plant in Wales and the coal hydrogenation plant in northeast England, have become the nucleus of new chemical industries, and the British chemical industry will continue to profit from the stimulus which emergency requirements provide in peace as in wartime.

What then are the prospects of the American chemical producer considering the British market for exports of his product? U. S. chemicals have earned for themselves a high reputation among many consumers who were introduced to them for the first time during the war. Great Britain will continue to provide a large market for such U. S. export articles as carbon black (needed in huge quantities by synthetic rubber makers), and the prospect of full employment at least in the reconstruction period of the next five years suggests that British demands for such products will be bigger than ever.

So far as competitive products are concerned, preference will be given to home manufactures. Where imports are neces-

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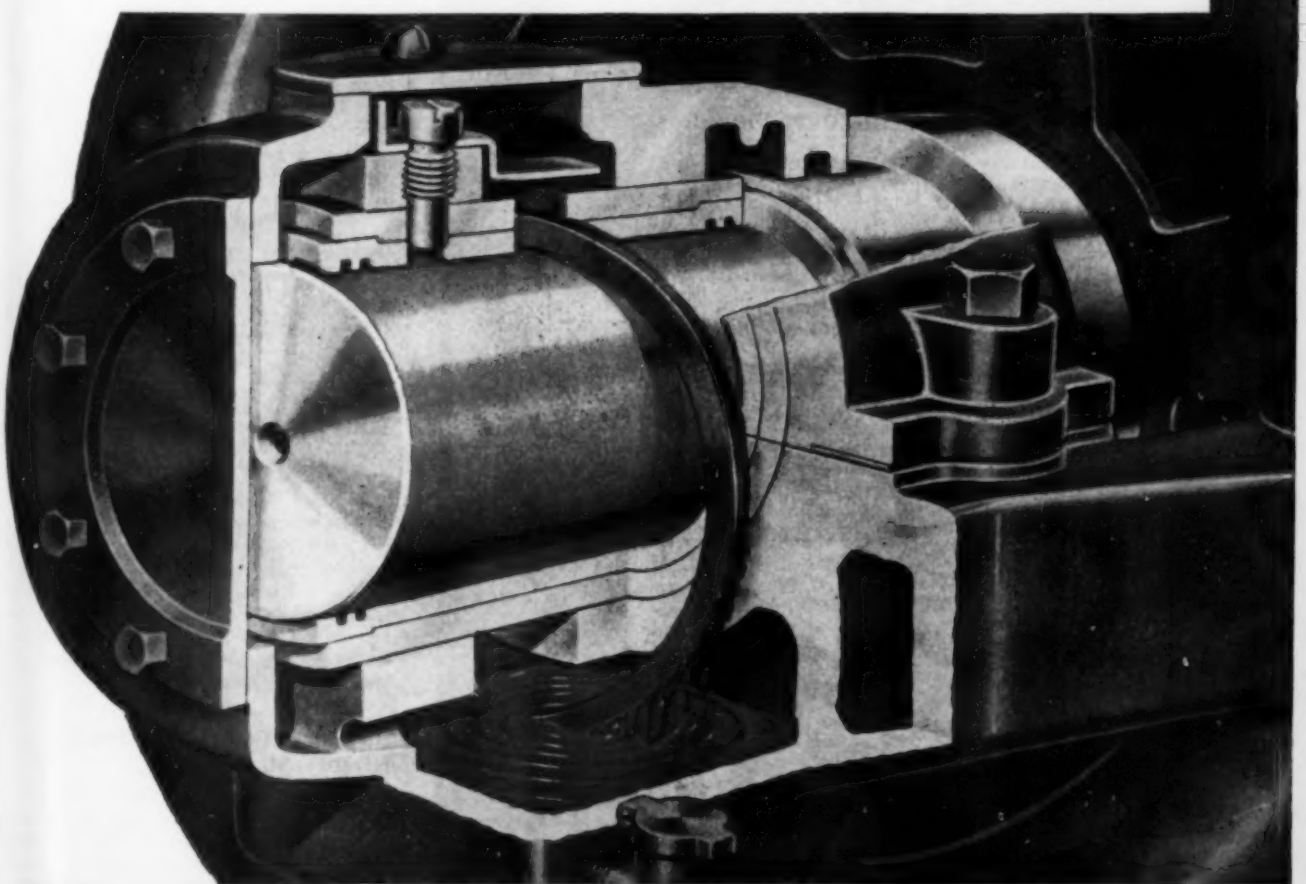

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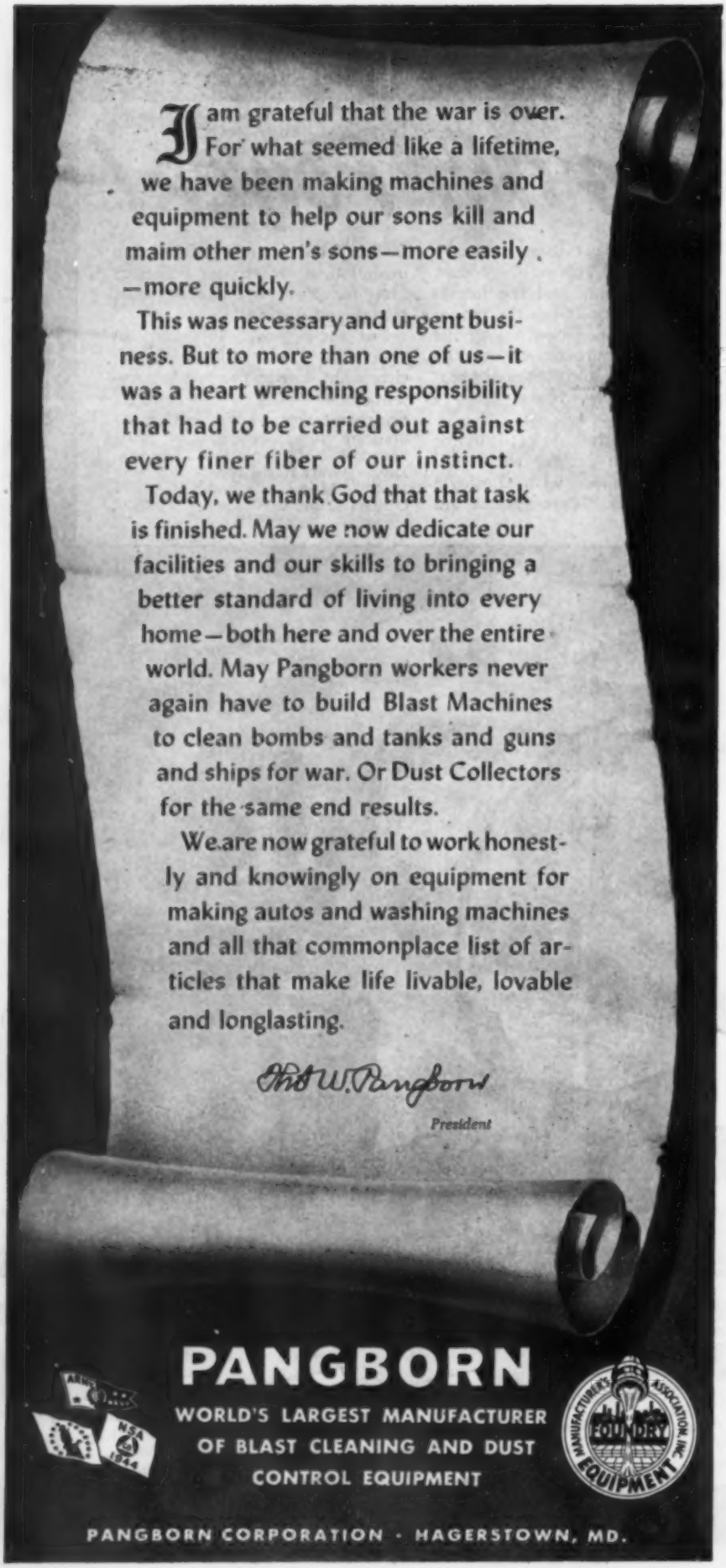
I am grateful that the war is over. For what seemed like a lifetime, we have been making machines and equipment to help our sons kill and maim other men's sons—more easily . —more quickly.
This was necessary and urgent business. But to more than one of us—it was a heart wrenching responsibility that had to be carried out against every finer fiber of our instinct.
Today, we thank God that that task is finished. May we now dedicate our facilities and our skills to bringing a better standard of living into every home—both here and over the entire world. May Pangborn workers never again have to build Blast Machines to clean bombs and tanks and guns and ships for war. Or Dust Collectors for the same end results.
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sary, importation of the crude material will be preferred to purchase of finished products, and price and cost considerations will decide the issue only with such modifications as Britain's tight foreign currency position necessitates. On the other hand, there is no desire on the part of the British authorities to deprive the country of the advantage of cheap foreign sources. The example of German self-sufficiency is only too vividly in everybody's mind to evoke any enthusiasm for experiments in that direction, and both the authorities and industrial circles welcome every opportunity for cooperation with American producers whose efficiency and enterprise have aroused admiration among British visitors to the States. Yet at the moment it seems that financial considerations may draw narrow limits to an expansion of British chemical imports from U.S.A.

FRENCH MOROCCO PHOSPHATE PRODUCTION DECLINES

Throughout 1944 and in the early part of this year, production of phosphate rock in French Morocco was on an upward trend. By the end of the first quarter, however, it began to decline so that the program calling for an output of 2,600,000 tons this year may not be fulfilled. Shortages of electric power, coal, labor, and equipment were the main difficulties. Drying of the rock and its transportation to port are the critical stages of production.

NEW CHEMICAL PRODUCTION PLANNED FOR INDIA

According to a recent survey, there is a possibility of developing a chemical industry in the Province of Orissa, India. The survey suggests the manufacture of salt and alkalis including soda ash, sodium hydroxide, and bleaching powder. Limestone is available for calcium cyanide when cheap electric power can be had. It also is planned to produce chemicals from coal and wood distillation.

In the State of Jodhpur, a company is reported to have been formed for the production of heavy chemicals with bitterns from Sambhar Lake to be used as the raw material. Other projects planned for that state include construction of paint and bone-crushing plants.

BRAZIL INCREASES SUPPLY OF DRYING OILS

For some time, Brazil has been assuming a position of greater importance as a producer of drying oils. In the first place, that country has been crushing a relatively larger percentage of its castor seed supply. In 1943 Brizilian production of castor oil amounted to 18,733 metric tons of which 12,624 tons was exported. This was exported in the form of raw oil but a good part of it was specially treated in the consuming countries to make it serve as a drying oil.

Production of linseed oil has been expanding although the latest available figures are for 1941 in which year production was 8,882 tons. Current outputs are nearly sufficient to cover domestic requirements as imports last year were but 44 tons.

Annual production of oiticica oil

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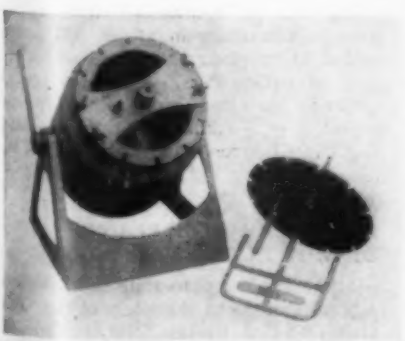

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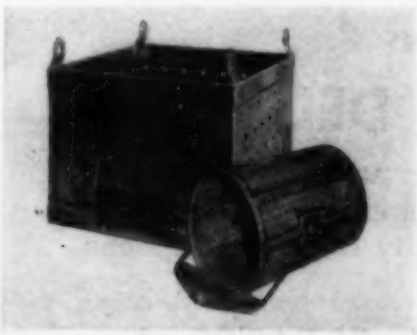

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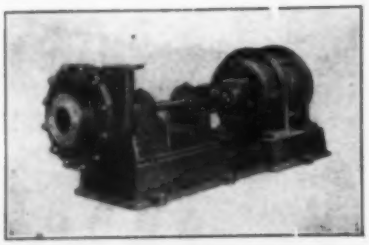

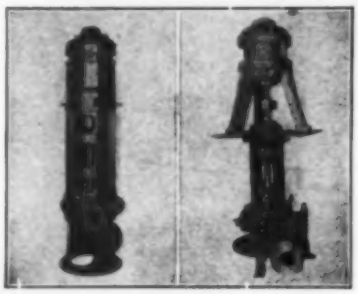

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probably will reach 10,000 tons. Last year Brazil exported 6,400 tons of this oil. A combination of castor and oiticica oils is used in oil paints made in Brazil. The tung oil industry has come along slowly with 1944 production amounting to 75 tons.

NEW GYPSUM PLANT AT CALGARY, CANADA

CONSTRUCTION work is said to be well advanced on a new gypsum plant at Calgary, Alberta Province, Canada. When in full operation, the plant will employ about 50 people in the making of a wide variety of gypsum products from raw materials obtained from the company's mines near Cranbrook, British Columbia. Estimated cost of the installations is $250,000.

COOPERATIVE RUBBER PLAN FOR GUAPORE, BRAZIL

IN AN attempt to stimulate production of rubber, a cooperative project will be tried out in the Territory of Guapore where a fertile growth of wild rubber indicates that the area may be useful for planting rubber. The plan includes the offering of 10 hectares of land to any settler who will live on it for three years and plant 1,000 rubber trees which are to be supplied by the Territory. Other facilities to be offered are machinery for clearing the land and a central cooperative which will buy supplies for the settlers and will likewise buy the rubber when produced. An agricultural expert of the cooperative also will service the plantation.

MEXICO MAY OFFER MARKET FOR SULPHURIC ACID

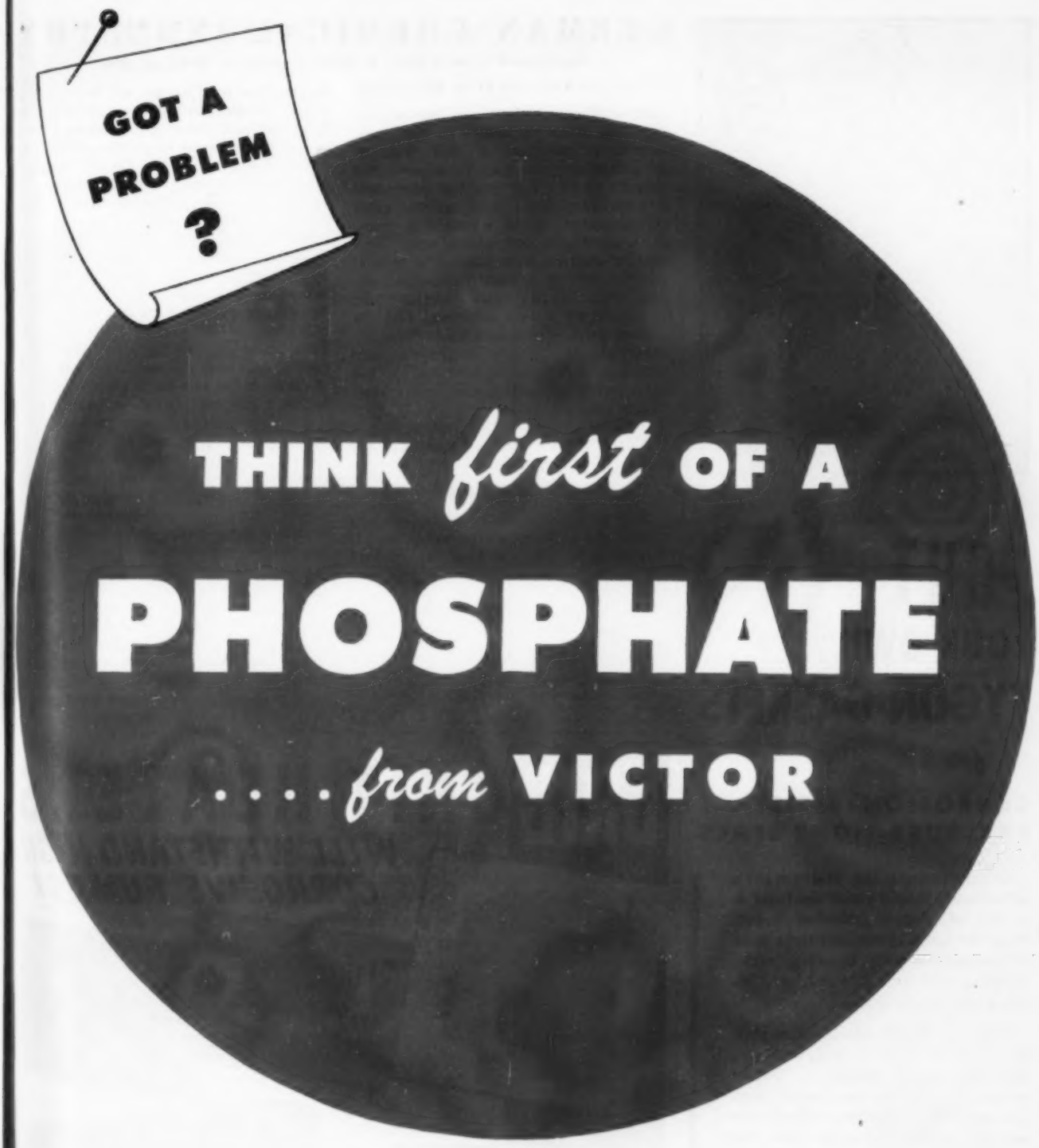
BEFORE the war, Mexico produced enough sulphuric acid not only to take care of all domestic needs but also had a small surplus for export to Central and South America. The large industrial development in Mexico in recent years has greatly increased requirements for acid. The present shortage has created interest in expanding production but in only one case has actual new construction resulted. Hence, it is expected that purchases from the United States will assume larger proportions in the immediate future.

SPAIN EXPECTED TO IMPORT ANILINE DYES

BECAUSE of greater activities in the principal consuming industries, Spain is reported to be planning to increase its imports of aniline dyes. Under the present set-up in producing countries, the dyes are expected to be obtained principally from the United States and the United Kingdom.

NITRATE OF LIME PLANTS RESUME IN NORWAY

UNOFFICIAL reports state that efforts to prevent damage to the works of the Norsk Hydro Co. at Rjukan, Norway, prior to the German evacuation were successful and the electrochemical installations and power plants were in full operation in July. The plant has an annual output of 200,000 tons of nitrate of lime.



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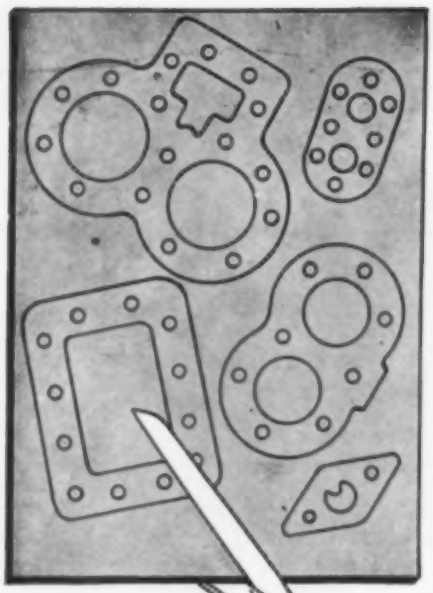

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GERMAN CHEMICAL INDUSTRY

Continued from *Chem. & Met.*, September 1945, p. 206

10. LUBRICANT AND FUEL ADDITIVES

Besides the usual tetraethyl lead in gasoline, little attention seemed to have been devoted to additives of this class. A polyisobutylene was used to improve the viscosity of oil. Polyvinyloleyl ether and its copolymers with vinyl isobutyl ether were reported to be outstanding pour-point depressants for mineral oils. Two gasoline additives were claimed to prevent the corrosion of internal combustion engines when injecting water into the intake by depositing a rust inhibiting film on exposed parts. These were made from (a) dodecylphenyl chloride condensed with glycine (cyclohexylamine salt) and (b) isobutyl cyclohexyl butyric acid (cyclo hexylamine salt).

Calcium benzoate (2 percent) was added to tropical greases to increase the melting point.

11. SUBSTITUTES

How far-reaching shortages of raw materials may exist in a country at war is illustrated by Germany's efforts to find substitutes for soap, glycerol, emulsifiers, and waxes.

The Gendorf plant Anorgana A. G. produced detergents from acetylene by hydrogenation to ethylene which was converted to ethylene oxide via chlorhydrin. Ethylene oxide was used for making glycols or was reacted with long-chain alcohols to obtain detergents of the Leonil, Genapol or Igepon classes. The production of ethylene for these purposes amounted to 25,000-30,000 tons yearly.

At Hoechst, 1,530 tons of Glycerogen, a glycerol substitute, was produced in 1944 by two-stage hydrogenation of inverted hexose using a nickel catalyst at temperatures ranging from 80 to 200 deg. C. and a pressure of 300 atm. Glycerogen contains about 40 percent glycerol, 40 percent propylene glycol and 20 percent hexyl-alcohols. It can be used in place of glycerol for most purposes except for explosives.

Synthetic fatty acids were produced on a large scale in Germany at a number of different points by the air oxidation of paraffins recovered from the hydrogenation of brown coal or lignite. Eighty thousand tons of fatty acids per annum were produced in three plants and a further plant was under construction. The C_5 to C_{18} fraction of fatty acids was treated and converted into edible fats.

Dry yeast was produced at the Zellstoffabrick Waldof from waste liquor of a beechwood pulp plant at the rate of 14 tons a day from 200 tons of dry wood. This yeast, containing 40 to 50 percent protein, was used to produce soup powder and other protein containing foodstuffs.

In making these data available to the United States industry and the public, warning is given that United States citizens interested make use of them at their own risk in so far as U. S. and foreign patent violations are concerned.

GRID UNIT HEATERS
..WILL WITHSTAND HIGH CORROSIVE FUMES!

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HERE'S WHY

• One piece construction heating sections (patented) of high test cast iron and will withstand steam pressures up to 250 lbs.

• No soldered, brazed, welded or expanded connections to become loose or develop leaks.

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• No electrolysis to cause corrosion, breakdowns, leaks or heating failures. That's why GRID Unit Heaters withstand the corrosive fumes in chemical plants without maintenance. In many plants where the corrosive fumes of HCl and Cl, are prevalent GRID Heaters have been operating for 8 or 10 years without maintenance. Complete information upon request. New booklet "Corrosion in Unit Heaters" contains information you should know before you install a unit heater.

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D. J. MURRAY MANUFACTURING CO. WAUSAU, WISCONSIN
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Offices in all principal cities.

What! Horse Collars Aboard Ships?

★ *To the ordinary landlubber this is only a queer looking piece of pipe; but to the marine engineer it is a Morison Type Corrugated Furnace, one end horse collar, other end plain. Such furnaces are a vital part of the compact, sturdy and efficient Scotch Marine Boilers that power so many small cargo vessels.*

For more than 30 years Taylor Forge has been the leading American maker of these fireboxes. Experience thus gained has added its share to our knowledge of how hot metal behaves —how to make it go where you want it to go.

YES, if you know how to make forging-temperature metal go where you want it to go, and in the right amounts, there are a lot of things you can do—and do *better.* Take Welding Fittings, for example, specifically welding elbows. You can have:

- Full pipe wall thickness at all points *plus* the right amount of reinforcement to provide full, uniform strength . . . as WeldELLS have.
- Tangents that help in lining up and keep the welds away from the zone of highest stress . . . as WeldELLS have.
- Perfect circle cross section for best flow conditions . . . as WeldELLS have.
- Finest metallurgical structure for greater strength . . . as WeldELLS have.

If you add such features as quarter-marked ends, permanent and complete identification marking, machine tool beveled ends, extreme dimensional accuracy, then you have fittings like WeldELLS: for indeed—

WeldELLS have everything

WeldELLS alone combine these features:

- **Seamless**—greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement**—provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P.O. Box 485
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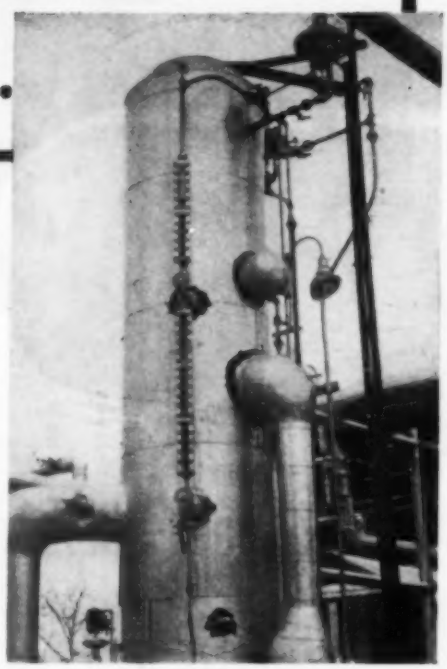
Check the Level ... and Believe What Your Eyes See...



There's something reassuring about a Jerguson Liquid Level Gage. You read and know your reading is correct. You read and know that your eyes aren't playing any tricks.

"Readability" has been designed into both Reflex and Transparent Types of Jerguson Gages. The Reflex Gages produce that contrasting black—white effect, visible at considerable distance. The Transparent Gages give good "show-through" lighting effect which is particularly useful when the color or condition of the liquid must be observed.

Yes, Jerguson Gages are exceptionally "readable". And they're durable, too, being designed and constructed to withstand high temperatures, high pressures and corrosion.

Our nearest representative will be glad to give you further information.

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chiefly for the army. The yeast was sold at one mark per kilo.

Another source of food yeast was based on the growth of yeast on sugar produced from wood by the Bergius or other hydrolysis processes.

Because of the shortage of Rumanian oil, lubricating oil was synthesized in Germany by polymerizing ethylene with an aluminum chloride catalyst, producing a product with Engler viscosities of 3 and 6 and 100 deg. C. The production amounted to 500 tons per month.

12. INSECTICIDES AND RODENTICIDES

DDT was widely manufactured in Germany and a number of variations were developed, such as difluoro diphenyl trichlorethane, known as Gix, and phenyl chlorophenyl trichlorethane. The former was more easily emulsified and was claimed to be more effective than DDT although much more expensive. No other variations of the DDT molecule appeared advantageous.

An entirely new approach was taken in the development of "Lauseto neu" which is a chloromethyl-4-chlorophenyl sulfone, said to be more active than DDT on the body louse and on bed bugs, but less so on flies. A mixture of the analogous chloromethyl phenyl sulfone and 3,4-dichlorobenzyl alcohol was even more active against bed bugs. Another new compound for uses similar to DDT is Lucex which is not as effective as DDT but is cheaper and is made by chlorinating the side chain of ethyl chlorobenzene.

For plant lice the hexaethyl ester of tetraphosphoric acid, Bladan, was more effective than nicotine although suffering from instability in aqueous solution. Nirosans, the active principle of which is tetranitrocarbazole, was used for control of insects and fungi on vines, with and without addition of copper compounds. For similar purposes sprays based on 1-sulfocyano-2,4,-dinitrobenzene were used. Pentachloronitrobenzene and 1,2,4 trichloro-3,5-dinitrobenzene were employed as soil disinfectants and the former was also used to disinfect wheat seed.

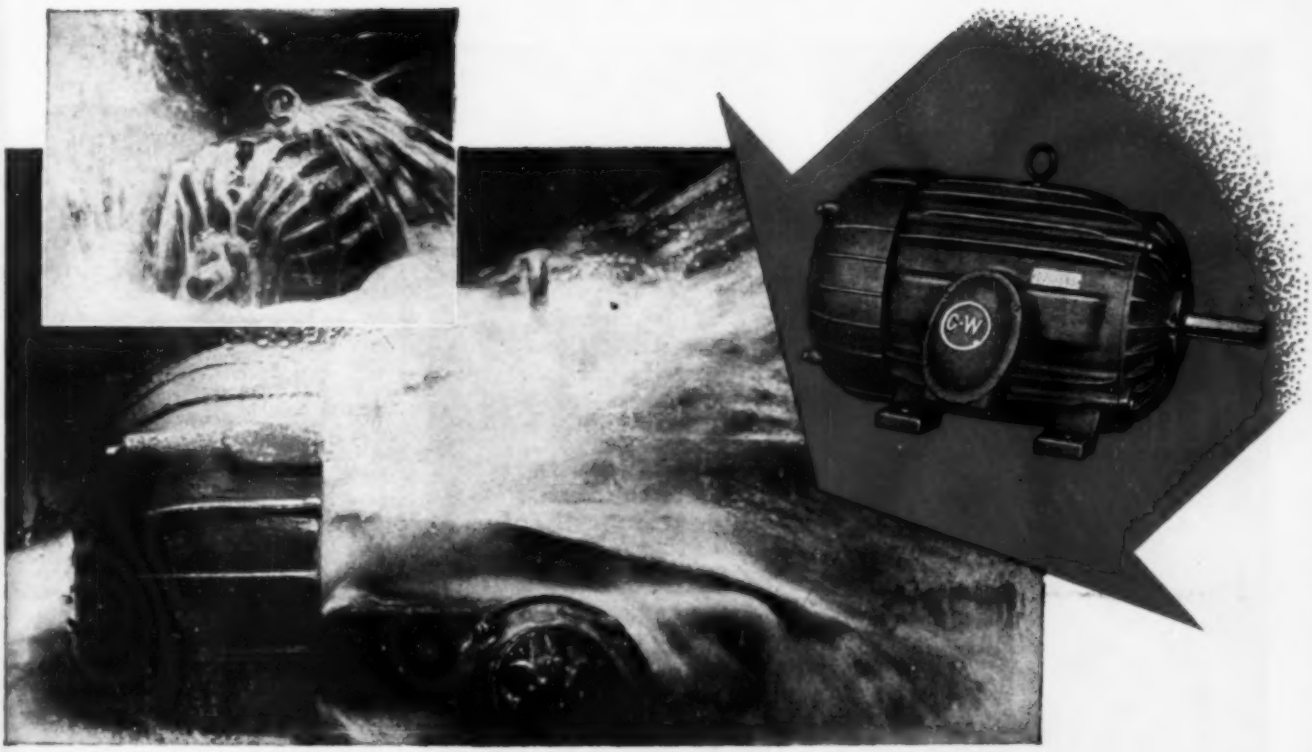
While diethyl phthalate was largely used as a mosquito repellant, a very new compound, trichloracetyl chorethylamide was being tested. It appears to be effective against mosquitoes other than the anopheline (which is the malaria carrier) and superior to the phthalates.

The problem of replacing thallium in rodenticides became quite acute. Castrix was made from acetoacetic ester and urea followed by chlorination and amination. It is very toxic to mice but low in toxicity for domestic animals. A very new compound, para-dimethylaminophenyl diazo sodium sulfonate, was under development as another substitute for thallium in rodenticides.

Continued development of the Eulan moth repellants resulted in Eulan NK, triphenyl-3, 4-dichlorophenyl phosphonium chloride, particularly resistant in textiles to washing, and Eulan AL, 3,4-dichlorophenyl-N-methyl sulfoneamide which was produced in large quantities.

13. PULP AND PAPER

Prehydrolysis of beechwood with 2.5 percent sulphuric acid and production of



A MOTOR takes a bath to prove a point

You can easily see that this new a-c **SEALEDPOWER** is a unique motor—with many exclusive features—but how will it stand up under really tough operating conditions? Can it withstand excessive moisture? What will be the effect of large quantities of dust in the surrounding atmosphere?

Answers had to be found to these questions before the motor could be offered to industry as an *improvement* over existing fan-cooled designs. So two brutal tests were devised:

In performing the first test a standard **SEALEDPOWER** motor was placed in a tank containing six inches of water, and run for eight hours without stopping; it was then shut down and the operation repeated the following day. All during the operating period the ventilating fan of the motor continued to throw water over the frame, shields, bearing housings, shaft and junction box (see illustrations), thoroughly drenching the entire exterior of the motor and yet, at the end of the test, the motor was taken apart—and the inside was found to be "bone" dry! Excessive moisture will offer no problem to this motor.

In the second test, a dense atmosphere of French chalk was kept whirling around the motor by means of fans. But, at the conclusion of this test, not a trace of chalk was found on the windings or elsewhere within the motor—conclusive proof that the **SEALEDPOWER** motor is truly dust tight.

An exclusive Crocker-Wheeler design, the **SEALEDPOWER** motor is suitable for applications where you have been using conventional fan-cooled motors. Why not try one of these motors—in an unusually damp or dusty location?

Send for full information. Please write on your company letterhead—no obligation.

THIS COUPLING IS UNIQUE, TOO

The Crocker-Wheeler resilient flexible coupling consists of a spider, a flange, a ball retaining cover and six synthetic rubber balls—that's all there is to it! And yet, this is more than just a trouble-free coupling—it actually adds years to the life of both the driving and driven machines.

The balls transmit torque, absorb shock and vibration, yet do not transmit end thrust. Available for shaft diameters up to 8", these couplings require no lubrication, no maintenance of any kind. Write for complete information.

CW-7

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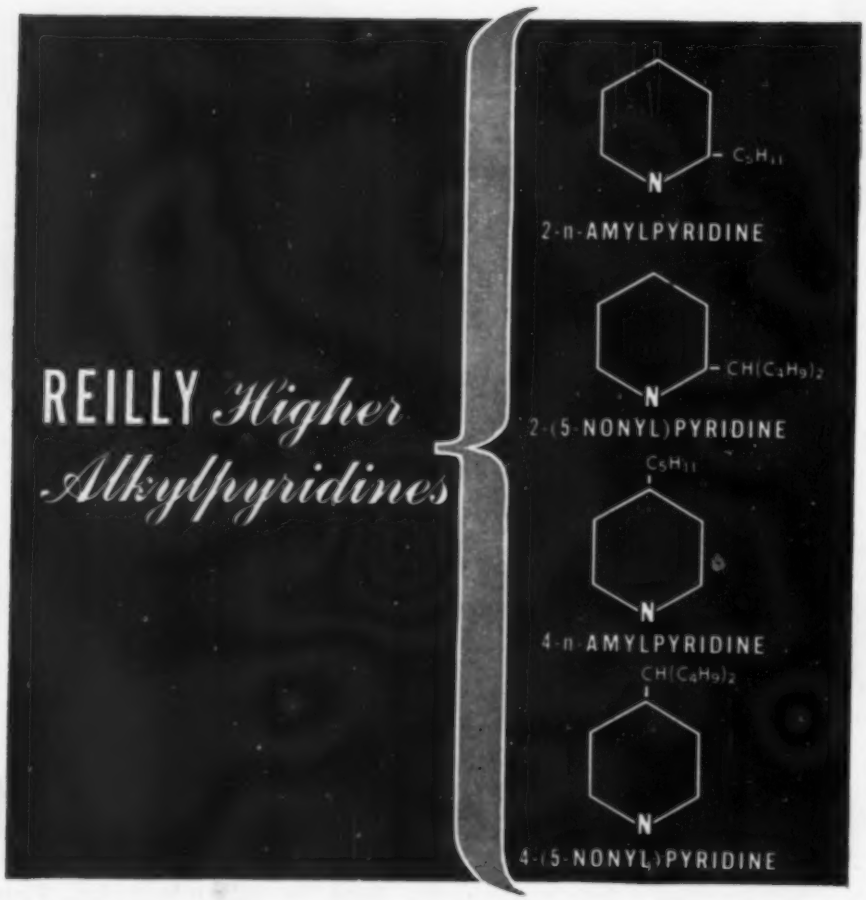
SQUIRREL CAGE MOTORS WOUND ROTOR MOTORS DIRECT CURRENT MOTORS GENERATORS FLEXIBLE COUPLINGS



Four new and interesting alkylpyridines are now available through Reilly Tar & Chemical Corporation. Each of the materials is produced in 95% purity. Suggested uses for these alkylpyridines are in the manufacture of disinfectants, medicinals, insecticides, rust preventives, anti-oxidants, rubber accelerators, wetting agents and in various organic syntheses.

OTHER REILLY BASES: Pyridine, Alpha Picoline, Beta Picoline, Gamma Picoline, 2,6-Lutidine, 2-Hexylpyridines, 2-Vinylpyridine, 2-Aminopyridine, Quinoline, Quinaldine, Lepidine, Isoquinoline, 3-Methylisoquinoline.

Send for 56-page booklet describing the complete Reilly line of coal tar bases, acids, oils, chemicals and intermediates.

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Reilly COAL TAR PRODUCTS
★ 17 PLANTS To Serve the Nation

yeast from the hydrolysis liquors were combined with treatment of the wood residue by the kraft process to produce a pulp of 96 percent alpha content. Unbleached sulphite pulp of 88-90 percent alpha content was successfully used for the manufacture of nitrocellulose for explosives.

Where waste or cheap nitric acid was available, 98 percent alpha pulp was produced especially suitable for acetate silk. Cellulose was being reduced with hydrogen at high pressure and 160 deg. C. to produce a mixture of glycerine and glycols.

Binder twine made from wet strength treated sulphate paper had successfully replaced sisal. A hybrid poplar was developed which analyzed up to 50 percent cellulose and can be grown in 8-10 years to 8 in. diameter. Products present in bisulphite waste liquors from the pulp industry were condensed with 4:4' dioxy diphenyl sulphone and formaldehyde to form a useful tanning agent. No evidence was found of the production of vanillin from waste liquors from pulp.

14. PHARMACEUTICALS

Due to Germany's large prewar capacity for producing pharmaceuticals, of which more than half was for export, she had little difficulty until near the end of the war in supplying the internal drug needs of the country, including war requirements.

The I. G., Merck and Schering companies occupied a dominant role in this field. The I. G. particularly had entered almost all phases of the drug field, including synthetic and natural drugs, sera and vaccines, vitamins and hormones. Merck produced synthetic and natural drugs, including alkaloids; the latter class was also prominent in the lists of the two Boehringer firms and of Hofmann La-Roche. The plants of most of these firms were largely intact.

At Marburg, the I. G. Behringwerke operated Germany's largest serum and vaccine manufacturing establishment, using about 2,000 horses and 1,500 smaller animals. Their products were generally produced by standard and well-known methods, but many of their processes appeared to be less efficient than our own.

The main dependence for anti-bacterial agents was placed on the sulfa drugs, although their production of these did not appear to be particularly efficient. Supplies of sulfathiazole and sulfadiazine were short at the end of the war, as was the case with Marfanil, a sulfonamide on which they relied largely for the treatment of anaerobic infections. Apparently this compound was used so widely because Germans had failed to develop a satisfactory production method for penicillin. Another new sulfonamide was Schering's Globucid (p-aminobenzenesulfonamide-ethylthiodiazole), which was produced in quantity largely because of its lower cost as compared to sulfadiazine.

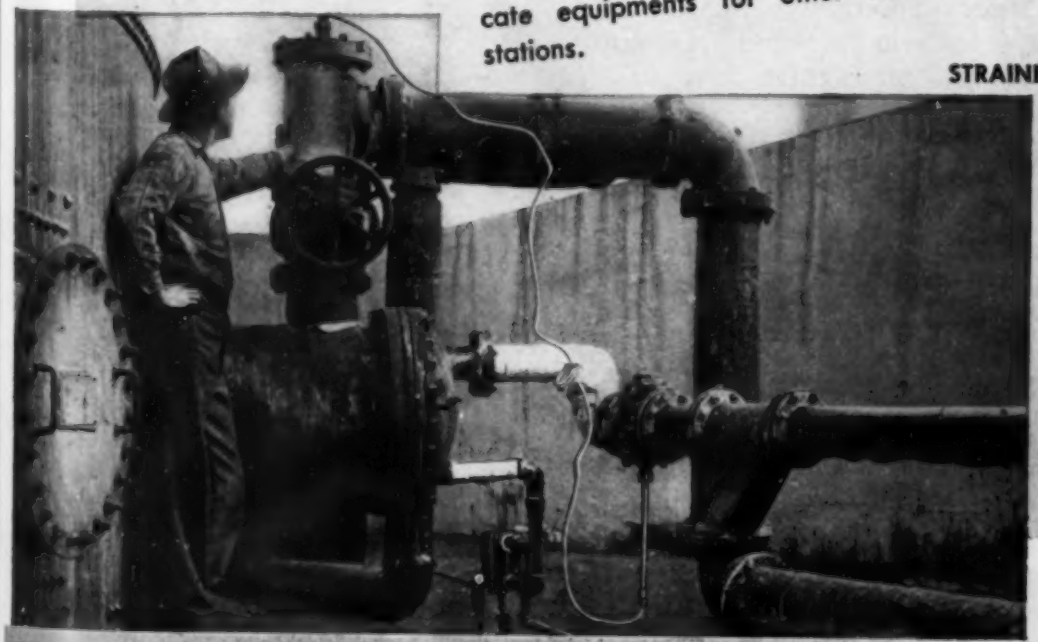
It had been observed that certain halogenated derivatives of Salicil are effective antagonists to p-aminobenzoic acid. This led to their study as antibacterial agents, but their value was still in doubt when the war ended. The dibromo compound

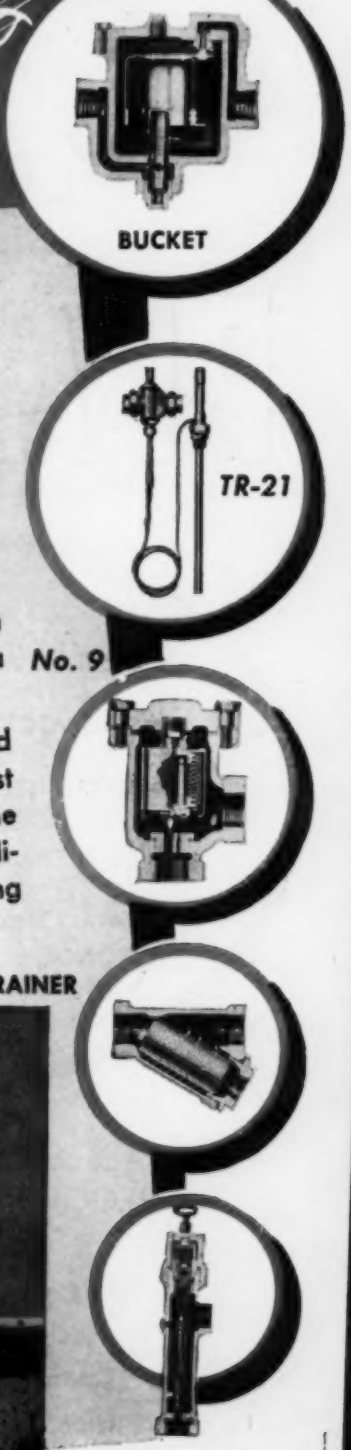
WHAT MESSAGE HAS THIS TANK . . . FOR YOU?

In dozens of industries there are large tanks of liquid which cannot be pumped unless heated. Pumping is at a high rate one minute and then no action at all for hours. The liquids should be pumped at the exact temperatures.

In the fuel oil industry, it's a "must" because false meter readings may occur at temperatures above 120 degrees. So the accurate and reliable Sarco TR-21 temperature regulator is hooked up to a nest of fin type heating coils inside the tank and of sufficient surface to heat the oil as it flows. The regulator valve is protected by a Sarco strainer. Condensate is removed from the heater coils by a Sarco bucket steam trap fitted with a Sarco Thermodrain set at 40 degrees to prevent freezing. Steam supply line is dripped by a Sarco No. 9 thermostatic steam trap with a Sarco ¾" strainer.

It's a message of co-ordinated efficiency. Seven different, but "blood related" Sarco products working together on one job and the cost according to the manager is already forgotten because of the improved service. They are ordering duplicate equipments for other distributing stations.





BUCKET

TR-21

No. 9

STRAINER

THERMO-DRAIN

105

FOUR STARS ON OUR E PENNANT TESTIFY TO SARCO PERFORMANCE IN THE WAR EFFORT

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- SHEET, WIRE, GAUZE, FINE FOILS.
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For a complete listing of our precious metal products for the Chemical and Metallurgical industries, send for our Catalogue C-17.

THE AMERICAN PLATINUM WORKS

N. J. R. R. AVE. at OLIVER ST. NEWARK 5, N. J.

was coded No. 3065, and the tetrachloro compound, No. 3214.

One outstanding development was the use of a synthetic polymer, polyvinyl pyrrolidone; this in 2.5 percent solution found use as a blood substitute for the treatment of shock. Over 300,000 units had been used for military personnel, evidently without deleterious effects. The product was called Periston.

Tropical diseases, especially malaria, received much attention at Elberfeld; this was particularly the case up to the time of the loss of North Africa. Atebrine continued to be produced in large quantities, and numerous other antimalarials were investigated, especially Sontochin, a quinoline derivative. Some of these showed some promise, but new important ones to act on other stages of the malaria parasite appeared to have been developed. Some new organic compounds of antimony were also made and had reached the clinical testing stage. There were no outstanding new developments for the treatment of venereal diseases.

Alkaloids and other plant extracts have long been important manufactured items in Germany, and large quantities were produced during the war. Caffeine was made from theobromine until cocoa imports were cut off, then a purely synthetic process was mainly used. Similarly, when imported opium could no longer be obtained, lower yielding domestic poppies were employed.

Hormones and vitamins, both synthetic and natural, were apparently in large demand and production in Germany. In a number of instances technical improvements had been made in their methods of manufacture. Attempts to synthesize vitamin A were not successful.

The types of equipment used for drug manufacturing were not greatly different from those used elsewhere. However, the scale of operations was generally smaller than in the United States; for example, kettles, tanks and stills were usually not larger than 1,000 or 2,000 liters capacity, except in the cases of large volume drugs such as salicylates. Acetanilide and aminopyrine, of which very large amounts were still produced, and the sulfa drugs, were made in equipment of only moderate size. Meticulous care was given to purifications of the final products, and to the forms of the end products.

15. DYES AND OTHER DEVELOPMENTS

In the extensive field of dye chemistry many definite improvements in technique and synthesis were discovered in the various types of dyestuffs and intermediates.

In the field of solvents, in addition to the halogenated ethylene derivatives manufactured in such large quantities from acetylene, other interesting developments were uncovered. For example, hexyl alcohols were produced from acetaldehyde and butyraldehyde by alkali condensation followed by hydrogenation. Methyl pentane diol and triol were produced in considerable tonnage by converting acetone in diacetone alcohol and hydrogenating this chemical. These latter products found uses as solvents for lacquers.

Sodium amalgam drawn from the mercury cell for chlorine manufacture was reacted with sodium polysulphide (made

This PRESSURE-TREATED wood structure got its test by fire . . . and PASSED with high honors

When this structure was built in 1942, the engineers specified Koppers Fire Retardant Treatment for the posts, girders, beams, joists and roof sheathing . . . and their foresight paid big dividends.

Recently a spark from a welding machine ignited waste lacquer in a pit below the floor. Flames shot up and mushroomed under the roof. A stream of water was directed to the roof but almost immediately diverted to the pit when it was observed the flames were not spreading along the treated timbers.

When the fire was extinguished, it was found that the metal lighting fixtures within a ceiling area of 20' by 110' were warped and ruined by the intense heat. The treated wood in the area directly above the fire was slightly charred but not sufficiently to require *any* replacements. Char on posts and girders was very light. Rafters in adjoining bays were slightly charred for half their length. *Normal manufacturing activities were resumed within three hours.* Experienced observers agreed that the fire retardant treatment had prevented serious damage to the building and interruption to important war production.

Fire retardance is only one of a number of important advantages of Koppers Pressure Treated Wood. It resists decay. It does not require periodical maintenance. It can be prefframed to your blueprints, matchmarked and delivered ready for assembly by local labor. Ask for our booklet" Economical & Permanent Construction with Pressure Treated Wood."

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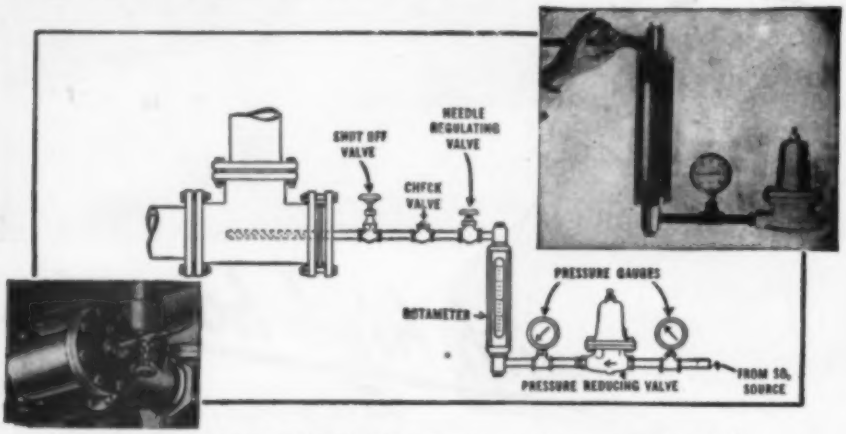
THE INDUSTRY THAT SERVES ALL INDUSTRY

END THE SULFUR BURNING NUISANCE IN YOUR PLANT... *Economically!*

Here is How!

. . . Replace Your Burner System with *Finger-tip Controlled* ANSUL SO_2



An Easy-to-Install Ansul SO_2 System gives you these Four Important Advantages

GREATER ECONOMY—Small investment in equipment, materially reduced operating and maintenance costs, and freeing of valuable floor space.

FINGER-TIP CONTROL—Easy, positive, finger-tip control providing extreme accuracy for reaction or adjustment of pH.

HIGHER PURITY—Elimination of impurities inherent in burner gases (Ansul Liquid SO_2 is 99.9+% [by weight] PURE).

GREATER SOLUBILITY—Solubility in water is 4 to 5 times greater than SO_2 from burner gas.

WRITE THE ANSUL TECHNICAL STAFF FOR FURTHER INFORMATION

LIQUID Sulfur Dioxide BY ANSUL

PHYSICAL PROPERTIES

Chemical formula	SO_2
Molecular weight	64.06
Color (gas and liquid)	Colorless
Odor	Characteristic, pungent
Melting point	−103.9° F. (−75.5° C.)
Boiling point	14.0° F. (−10.0° C.)
Density of liquid at 80° F.	(85.03 lbs. per cu. ft.)
Specific gravity at 80° F.	1.363
Density of gas at 0° C. and 760 mm	2.9267 grams per liter (0.1827 lb. per cu. ft.)
Critical temperature	314.82° F. (157.12° C.)
Critical pressure	1141.5 lbs. per sq. in. abs.
Solubility	Soluble in water
Purity	99.9+% (by wt.) SO_2 (H_2O less than 0.01%)

REG. U. S. PAT. OFF.

Send for Bulletin 020.1, "A Comparison of Ansul SO_2 and Sulfur Burner Gas," and also for your copy of "Liquid Sulfur Dioxide"—a treatise on the properties, characteristics, and industrial uses of Liquid Sulfur Dioxide—written by the Ansul Technical Staff.

WRITE: Dept. A.

ANSUL CHEMICAL COMPANY, MARINETTE, WIS.

Eastern Office 60 E. 42nd St. New York City

from one quarter of the sodium sulphide produced) to give a very pure sodium sulphide, while the mercury was returned to the cell for re-use thus:

$$6\ Na/Hg + Na_2S_x \rightarrow 4Na_2S + Hg$$

The use of substituted carbazoles as insecticide ingredients led to the development of some novel methods of synthesis.

The use of hydrazine hydrate as a rocket fuel, as previously mentioned, resulted in translating the usual laboratory synthesis of oxidizing ammonia with sodium hypochlorite to a large full-sized industry.

The need for thiodiglycol as an intermediate for mustard gas production led to the production of this chemical by a continuous process from ethylene oxide and hydrogen sulphide in very considerable tonnage.

The synthesis of caffeine by the well known Traube process, which starts with urea and sodium cyanoacetate to form diamino uracil followed by reaction with excess formic and exhaustive methylation, was reduced to industrial practice for the production of this valuable drug.

Diazoamino benzene and azo substituted compounds made from ketones were produced as additives for rubber compounding. These products at temperatures encountered during vulcanization decompose to give large and even supplies of nitrogen useful for making light-weight sponge rubbers.

This list of developments could be amplified very considerably but such extension would fall beyond the scope of this preliminary report. It is to be hoped that more detailed information can soon be made available for general use, because it is certain that the reports of these investigations will supply valuable ideas for the future development of the American chemical industry.

GERMANS SYNTHESIZE ACETYLENE CHEMICALS

THE BASIC work in utilizing acetylene as a raw material necessitated the technique of working with acetylene under pressure making it necessary to disregard the traditions concerning the danger of this type of reaction. As a result of this work a number of new reactions such as "vinylation" and "hydroxyethylation" have become almost as common as nitration, sulphonation, and other unit processes. Many of the products of these new unit processes are extremely valuable, especially to the Germany economy. Some of the more important of these will be discussed.

VINYL COMPOUNDS

These compounds include vinyl ethers, polyoxystyrenes, and vinyl esters of higher fatty acids, none of which have been commercially synthesized heretofore. Vinyl ethers have been successfully prepared by reacting acetylene with alcohol in the presence of a suitable catalyst. With methanol, for instance the reaction is such that an alcoholate is formed first from the alcohol and alkali hydroxide (catalyst). Acetylene then reacts between the oxygen and the metal, forming the metal salts of

calcium acetate*

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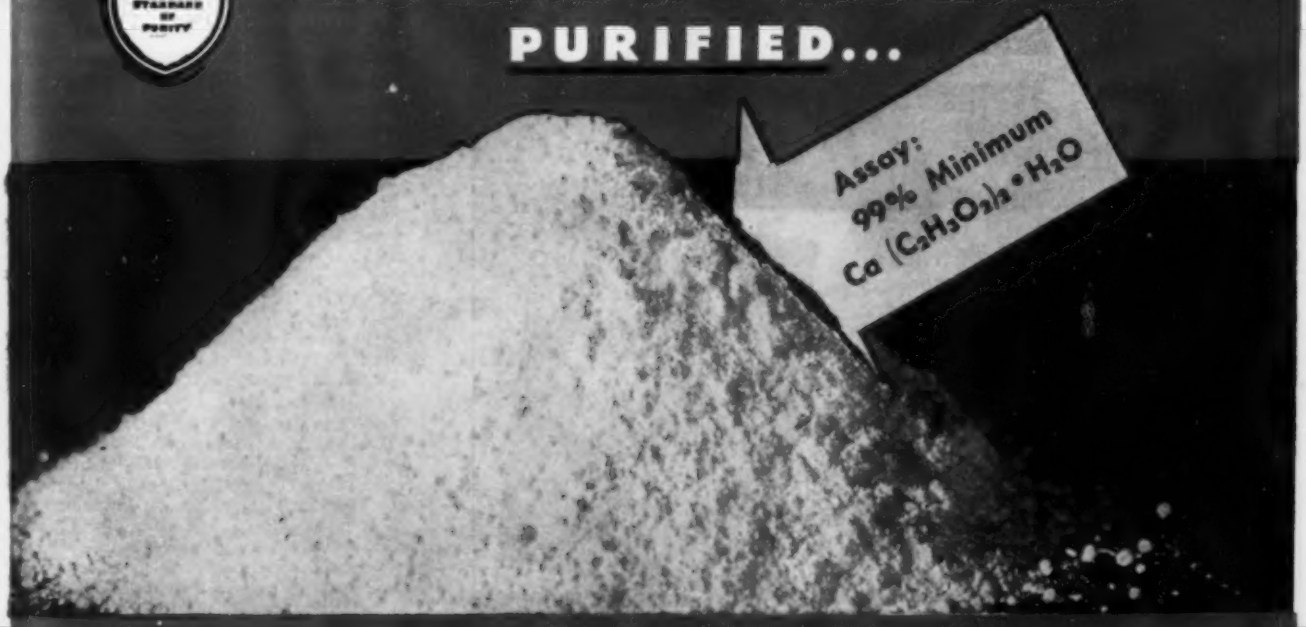

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HERE IS A QUALITY chemical . . . assaying 99% min. Ca $(C_2H_3O_2)_2 \cdot H_2O$ . . . which is far superior to ordinary acetate of lime for manufacture of plastics, pharmaceuticals, and other products where high purity processing materials are vital.

THE USEFUL APPLICATIONS of this B&A Fine Chemical are already evident in many fields; perhaps it has a place in your operations too. If so, let us know your requirements now. And remember—whether you need purified Calcium Acetate in bottle, drum or even carload lots—Baker & Adamson can supply it promptly and steadily. That's important when production schedules press!

*One of 1,000 high purity chemicals bearing the B&A shield of quality.

Setting the Pace in Chemical Purity Since 1882

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the corresponding vinyl ethers which then reacts with more alcohol to produce vinyl ethers and alcoholate, whereby the alcoholate again reacts further with the C_2H_2.

This vinylation reaction is, with few exceptions applicable to all organic compounds containing hydroxyl groups—not only to any aliphatic, aromatic and hydroaromatic compounds, but to heterocyclic hydroxy compounds as well. Reaction conditions, such as temperature, pressure, catalysts, solvents, etc., must be modified, of course, for particular reactions.

Manufacture of vinyl ethers is carried on only in continuous processes, both at atmospheric and high pressures, depending on the particular product. Where atmospheric pressure is used, for vinyl ethers which boil above the reaction temperature of 120 to 180 deg. C., the following basic equipment is used: a reaction tower containing raschig rings and provided with heating and cooling facilities (the reaction is exothermic), cooler, separator, gasometer, and a tank for the alcohol containing the catalyst (1 percent KOH). By means of a circulating pump a stream of pure acetylene is passed through the reaction tower filled with alcohol and catalyst, and heated to the reaction temperature. Vinylation proceeds rapidly; the acetylene consumed in the reaction is automatically replenished by the gasometer. Vinyl ether which is formed almost quantitatively is withdrawn continuously from the bottom of the tower, while at the top of the tower a corresponding quantity of alcohol and catalyst is fed in.

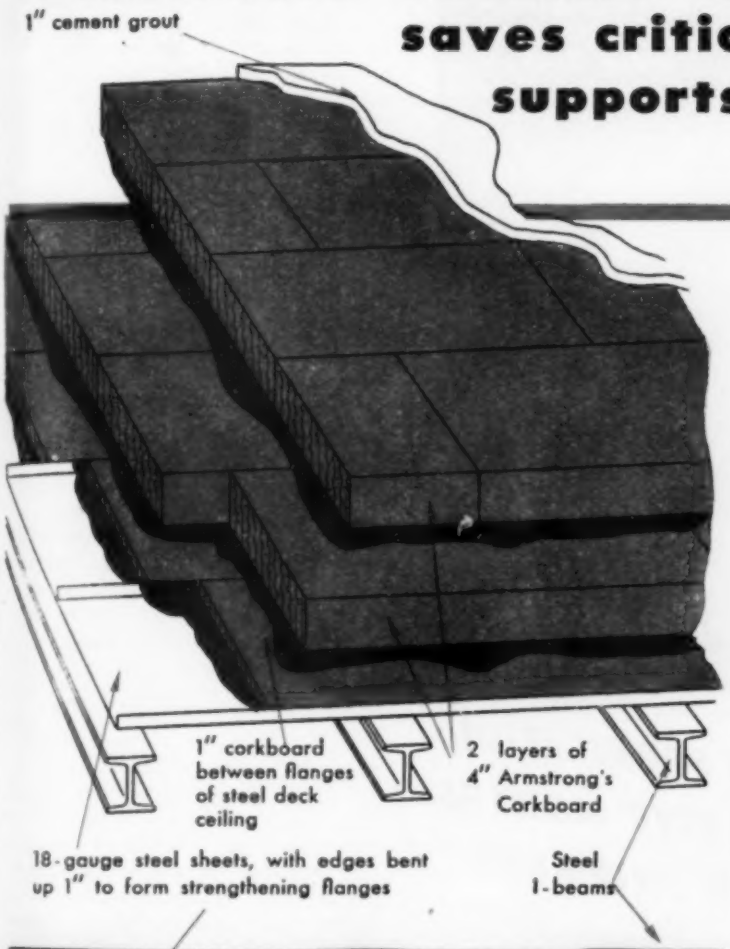
Vinylation of lower alcohols takes place under pressure. For instance, vinyl methyl ether is produced at about 15 atm., and vinyl ethyl ether at about 10 atm., corresponding to their vapor pressure and the reaction temperature. For safety, acetylene must be diluted with inert gases, such as nitrogen. Operation is slightly different than at atmosphere pressure. Acetylene makeup must be compressed and the alcohol pumped in; vinyl ether leaves the tower mixed with alcohols as an approximately 85 percent product along with the circulating gas, and is condensed and separated from dissolved acetylene and from alcohol by distillation. A plant scale pressure tower has operated continuously to produce up to ten tons per day of monomeric vinyl ether.

The most important reaction of vinyl ethers is their ability to polymerize easily resulting in thin to highly viscous oils, rubber-like products, or finally, hard, plastic to brittle resin-like materials. Major uses of poly vinyl ethers are in the coating, adhesive, textile and leather industries.

Polyoxystyrenes are produced when zinc or cadmium salts are used as catalysts and the reaction takes place in autoclaves at about 180 deg. C., under high pressure by batch or continuous methods. The phenol acetylene resins, formed by polymerization of polyoxystyrene, in combination with drying oils are suitable as varnish raw materials. Resins from alkyl phenol and acetylene are compatible with natural rubber and buna. The coating of buna sheets with a solution of these resins (Koresin) imparts the tack necessary for the fabrication of tires.

Vinyl amines are prepared by the addition of acetylene to amines utilizing such catalysts as alkalis or zinc and cadmium oxides. Polymerization of certain of these such as N-vinyl carbazole forms a product

UNUSUAL CEILING CONSTRUCTION saves critical materials— supports 9″ of insulation


1″ cement grout
1″ corkboard between flanges of steel deck ceiling
2 layers of 4″ Armstrong's Corkboard
18-gauge steel sheets, with edges bent up 1″ to form strengthening flanges
Steel I-beams

Insulation of a cold room before coils were installed, showing underside of steel deck ceiling.

It's possible, even when normal materials are not available, to build a good strong insulated ceiling. Here's how Armstrong's Contract Service recently constructed the low-temperature installation shown here.

Internal columns and a grid of I-beams were used. Sheets of 18-gauge steel were available, so these were bent up 1″ at the edges to form strengthening flanges and laid across the beams. Between the flanges, 1″ of Armstrong's Corkboard was laid in hot asphalt, and on top of the resulting flat surface, two more layers of corkboard, each 4″ thick, were applied. The whole ceiling was grouted with 1″ of portland cement. On the inside of the room, the underside of the steel deck was left exposed.

Walls and floor of this cold room are conventional corkboard construction. The walls are insulated with 9″ of Armstrong's Corkboard and the floor with 10″. Over the corkboard in the floor, a waterproof membrane was applied, and the floor was completed with a 4″ concrete wearing surface.

Perhaps Armstrong's Corkboard—and Armstrong's Contract Service—can help you solve your own special problems of insulation construction. For complete information, write to Armstrong Cork Company, Building Materials Division, 3310 Concord Street, Lancaster, Pennsylvania.

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To 2600° Fahrenheit

All types of tanks constructed —riveted or welded. Welding as per A.S.M.E. and A.P.I. Codes, including radiographing under paragraph U-68 of A.S.M.E. Code for Unfired Pressure Vessels.

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Air Ducts
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Troughs
Pipe
Pressure Vessels

STRUCTURAL WORK
Equipment Bases
Special Frames
Building Steel
Platforms
Walkways.

INGENIOUS FABRICATION PREVENTS FIVE MONTHS DELAY IN SHIPMENT

The tank shown above isn't a typical product of the Lasker Engineering Co.—but it does show a real bit of ingenuity in meeting an emergency.

Several welded steel tanks, six feet in diameter, were required for export. The contract for their construction was awarded to the Lasker Engineering Co., based on delivery in 6 months. After the contract was placed, the customer discovered that two of these tanks would be required in four weeks!

Lasker engineers, however, solved this difficulty by introducing two conical transition pieces so that five foot diameter heads that were in stock, could be welded in place and the tanks shipped on schedule.

The same ingenuity is available to you in the solution of your fabrication problems. Write for additional information today—no obligation.

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LE-5

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which can be molded either with or without heat and pressure.

Vinyl esters from fatty acids may be produced in similar fashion by use of zinc or cadmium salts of organic acids as catalysts, operating in the liquid phase under pressure at about 180 deg. C. These can be polymerized alone or in emulsion with other polymerizable materials. Especially noteworthy is the tall oil acid vinyl ester, already manufactured on a commercial scale which is used to replace linseed oil for color printing, and shows good results as a size material.

ETHYNYL COMPOUNDS

Certain of these compounds which are formed in a somewhat different manner than the vinyl ethers are the alkyneols in which acetylene reacts with aldehydes using copper acetylide as a catalyst. Depending on the aldehyde used, the reaction temperature is about 100 deg. C. and the pressure 3 atm. and higher. The pH must be kept constant at values between 2 and 7.

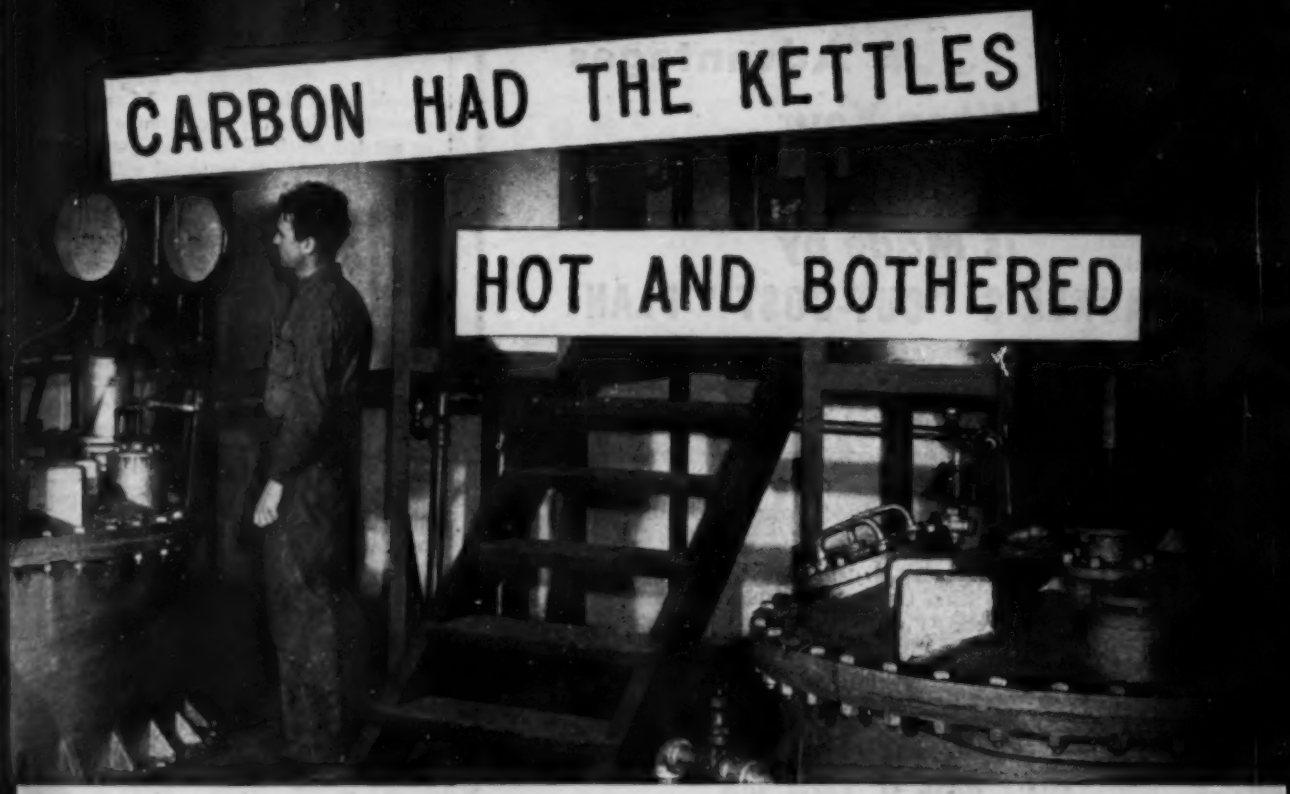
Generally, the reaction mechanism is as follows: first, a loose addition compound is formed from copper acetylide and acetylene which then combines with formaldehyde to form propargyl alcohol, and the regenerated copper acetylide combine again with acetylene to form the active complex. Propargyl alcohol, activated by copper acetylide, adds another molecule of formaldehyde forming butynediol.

Tetrahydrofurane, the primary dehydration product of 1.4-butylene glycol, is the most valuable intermediate of the butadiene synthesis. Because of its high solvent powers it can be used as a solvent to dissolve high polymers, such as polyvinyl chloride, polyvinyl carbazole, rubber, buna-S, etc. It is also the basic raw material for a large number of products. With HCl tetrahydrofurane is readily split, and, depending on the reaction conditions, a number of important compounds can be produced.

GERMAN SUBSTITUTE FOR MICA INSULATION

Due to the shortage of mica for use as insulation between commutator segments for their motors, generators, and dynamotors, The Robert Bosch Co. developed a substitute material which they claim is superior in every way to mica and one which they plan to continue to use even though mica should again become available. The trade name for this material is "Glushartgewebe" and it consists of several layers of impregnated glass fiber which have been bonded together under heat and pressure.

The glass fabric is purchased from textile mills by the following specification. The thread thickness may vary from 0.015 to 0.022 mm. in diameter. The weave must have between 19 and 21 threads per centimeter and the warp must have between 15 and 17 threads per cm. The finished fabric must weigh between 125 and 135 gm. per sq. m. and must have



SUN PROCESS OIL... Made Possible Uniform, Uninterrupted Heating, Eliminated 91% of Down-Time for Cleaning Out Oil Jackets

An organic dye manufacturer heated glass-lined kettles with hot oil, pumped through jackets. The process required exact and uninterrupted maintenance of temperature.

But hard carbon formed constantly on the linings of the jackets, changing the rate of heat transfer, and insulating the kettles so that the oil temperature had to be raised.

Frequent shut-downs were required to clean out the coke which built up and prevented circulation of the oil.

When fire resulted from the high temperature, a Sun oil engineer was called in to see if he could correct the situation. He recommended a special Sun processing oil with a low carbon content. The small amount of carbon residue formed is soft and fluffy, and easily removed when oil is changed.

Operating records for the last two years show that with this Sun oil make-up requirements have been reduced 66%, and that "down" time for cleaning out coke and replacing oil has been cut 91%.

The know-how and experience that enabled the Sun engineer in this case to bring about continuous, uniform, low-cost heating, are available to help you. Whether you require process oils, solvents, fuel oils, lubricants or other petroleum products, Sun engineers and Sun quality products are a combination that you should know about. For further information, write to . . .

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Right: PRESSURE HYDROMETER JAR—for measuring the specific gravity of liquids, which under atmospheric pressure would evaporate into a gaseous form.

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an alkaline content of between 6 to 9 percent. Samples of each lot of material purchased are given a heat test which consists of heating the material to a temperature of 450 deg. C. for a period of 10 min. The loss in the weight of the sample must be between 3.5 and 4.5 percent. This test is to determine whether or not too much oil has been used in the sheen process. Too much oil will prevent impregnation of the fabric.

The impregnation solution is prepared by mechanically mixing together the following materials until a homogeneous mixture is obtained: Resinol K2 (not fully polymerized) 53.30 percent by weight; alcohol (CR), 23.35 percent; osmose-kaolin (made by electrolytic deposition of kaolin in water), 23.35 percent.

The glass fabric is impregnated in a vertical type machine similar to those used in the United States for the production of varnished cambric. It is run at a speed of 1 m. per min. The amount of impregnating material used per unit length is controlled by passing it through adjustable pressure rolls. The material travels about 14 m. in the oven. It enters the oven at room temperature and reaches a maximum temperature of 120 deg. C. at the top of the oven and then cools back down to room temperature by the time it emerges from the bottom of the oven. Approximately 42 kg. of the impregnating material is required per 100 m. of the fabric. Alcohol is recovered.

The impregnated material is then cut into strips 1,500 by 95 mm. This is then folded into three thicknesses lengthwise and then molded under heat and pressure. This gives a molded piece of fiber 500 by 95 mm. which is the largest piece of material which can be molded and obtain the close limits in thickness required for insulting strips between commutator segments.

The molded material is then baked in an oven at a temperature of 210 deg. C. for 4 hr. to remove all of the solvent and is then in its final form.

Special nickel plated platens are used. They are machined very flat. Three strips of material are molded at one time. The molding press is closed slowly at first and the final 2 cm. are traveled at a relatively fast speed of 1 m. per sec. This is necessary because the material is not thermoplastic and to obtain uniform thickness the excess impregnating material must be displaced mechanically.

The material is pressed under a pressure of 350 kg. per sq. cm. at a temperature of 160 deg. C. for a period of 5 min. No cooling cycle of the press is required since the material does not change in dimension when removed from the press hot.

This material can be exposed to a continuous temperature of 250 deg. C. and temporarily to 320 deg. It is non-hygroscopic, no change in either weight or dimensions when exposed to a relative humidity of 100 percent, and temperature of 21 deg. C. for 24 hr. Thickness can be held to 0.055 plus or minus 0.00001 mm. The material is tested for electrical breakdown at 1,000 v. but it, of course, will stand many times that much voltage. There was no information on insulation

SERVICE REPORT

THE PARKER APPLIANCE COMPANY

Today I inspected the Parker Packing Test Machine, designed and built for Wright Field Aeronautical Laboratory.

The machine tests synthetic rubber packing rings for aircraft through a temperature range of +160° to -70°. Rings must withstand 70,000 cycles of operation at both temperatures.

Heat is provided by electric resistance coils and chilling by dry ice and alcohol. Distribution is by fan, and hydraulic system

a. Gives automatic control
b. Handles heat transfer -- both hot and cold
c. Holds and records pre-set temperature

The machine has had 2 years continuous service, without trouble of any kind -- a typical Parker service record.

The patented Parker triple type fitting—easy to install and service—proof against leakage and vibration.

The principle of this fitting is the basis for modern Fluid Power Systems.

The record of Parker fittings, valves and fabricated tubing is one of complete dependability in both war and peace.

Whatever you make, or plan to make, consult a Parker Fluid Power engineer on tubing systems for either fluid or power transmission. The Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.

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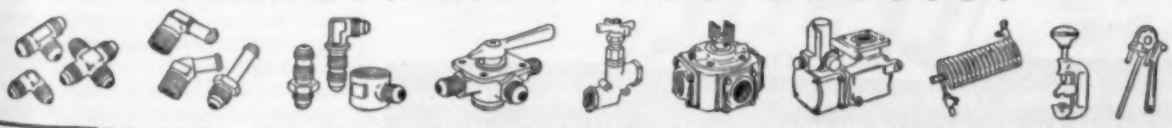

FLUID POWER PRODUCTS FOR ALL INDUSTRY

3 "OLD TIMERS"

S. Inglis Leslie, President, and R. J. (Bob) McIlwain, oldest employee and foundry consultant, inspect 35-year old veteran LESLIE Reducing Valve.

The above illustration marks three separate yet closely related records of service, each indicative of long-term LESLIE quality and reliability.

For, the recent arrival of a 10 in. LESLIE Class F Reducing Valve back for its first repairs after 35 years of hard service, likewise marked 40 years of service with LESLIE CO. of two men closely identified with long-life records of LESLIE Products.

This Reducing Valve, used for controlling steam to reciprocating engines, needed only minor repairs. Following that, it was again returned to the same service, after receiving (and successfully standing) the same rigid maximum steam pressure and operating tests which it underwent prior to shipment 35 years ago—ample indication of a quality that has kept abreast of the best in materials for regulator manufacturing and performance.

To borrow the words of one user, "These Reducing Valves give unbelievable satisfaction. Their constant reliable performance will please any engineer. They are as reliable as the setting sun."

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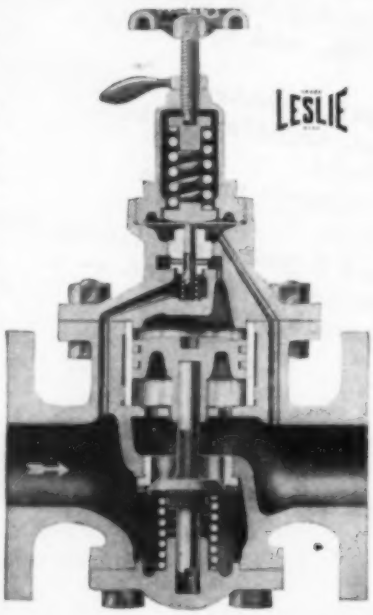

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resistance of the material or the effect of humidity on insulation resistance.

Any manufacturer set up to make phenol fiber could produce this material with the expenditure of a relatively small investment. Samples of this material should be tested thoroughly by a reliable materials testing laboratory and if it appears to have outstanding characteristics then specific uses can be recommended.

PRODUCTION AND USE OF RECLAIMED RUBBER

There seem to have been no large outstanding manufacturers of reclaimed rubber in Germany. Most of the larger rubber manufacturers operated a reclaiming plant to utilize their own scrap and to produce enough reclaim for their own needs with little if any effort to sell to other rubber manufacturers. There were a few small independent manufacturers of reclaimed rubber who sold their product chiefly to small rubber companies.

Manufacturers of rubber goods produced some of their own scrap of tires, tubes, mechanicals, shoes, etc., and purchased additional supplies. The rubber manufacturers had no well defined method of marking buna S products to keep them separate from natural rubber products. Hence it was difficult if not impossible to keep buna S scrap separated from natural crude rubber scrap. Germany never did produce neoprene and no effort was made to reclaim their perbunan.

Without exception each manufacturer interviewed stated all of his stocks of tires and other scraps had been burned by bombing and they knew of no accumulations of domestic supplies. However, there is plenty of battle scrap in evidence everywhere which is rapidly being collected by civilians which individuals make up into shoes, sandals, etc. At no time, however, during the war did any manufacturer suffer from insufficient scrap supplies.

The conventional two-roll refiners are in general use, but most of the plants favor, and their latest installations were, a three-roll vertical refiner made by Vogel. These refiners are relatively short, top and bottom rolls fixed and in line, middle roll offset and adjusted against top and bottom rolls with large friction ratio between rolls, take off knife on bottom roll. It is claimed this refiner has greater output and does a better job than the conventional two-roll refiner.

Germans have not developed any new techniques nor found any outstanding plasticizers to be used in reclaiming of buna S scrap as compared to natural rubber scrap. Nor was there any evidence that very much research work had been done on this problem.

Reclaim was generally not accepted for use in tires. It can be said that German reclaim was generally inferior to American. No effort was made to keep the crude and synthetic tires separate at the reclaiming plant since the synthetic tires had not been properly marked by the manufacturers. All the Germans with whom this subject was discussed admitted that the quality of German reclaim had deteriorated because of this. Reclaim dispersions were not used.

CORROSION FORUM

EDMOND C. FETTER, Assistant Editor

MODERN MATERIALS • MODERN METALS

LITERATURE REVIEW

"Analysis of Data in Cathodic Protection of an Open Condenser Box," J. J. Stadtherr, *Corrosion*, June 1945, pp. 70-82:—Discusses in detail the method of installation, operating data, and benefits derived from an application of impressed-voltage cathodic protection to prevent corrosion of condenser box and coils by cooling water. Condenser's function was condensing and cooling of straight-run gasoline in a refinery.

"The Role of the Straight Chromium Stainless Steels for Vessel Linings in the Refinery Field," W. J. Jackel, *Corrosion*, June 1945, pp. 83-94:—Traces and explains the shifts in popularity from one to another of the several grades of straight chrome stainless for service in reaction chamber, coke chamber, fractionator, bubble tower, catalytic reactors and the like.

"Progress Report on the Behavior of Zinc-Iron Couples in Soils," Melvin Romanoff, *Corrosion*, June 1945, pp. 95-102:—Reports the behavior, as indicated by electrical measurements, of some of the zinc-iron couples buried in 1941 by the Bureau of Standards to study the effectiveness of zinc anodes for cathodic protection.

"Preventing Boiler Metal Embrittlement," J. D. Betz, *Petroleum Refiner*, July 1945, pp. 98-102:—Describes Bureau of Mines device for testing boiler feed water to determine the likelihood of its causing embrittlement. Surveys the various water treatments currently employed to render feed water non-embrittling.

"Corrosion of Iron by Sulphides," Richard Pomeroy, *Water Works & Sewerage*, April 1945, pp. 133-138:—Theoretical considerations, remedial measures, and numerous examples of corrosion by septic sewage and other liquids containing dissolved sulphides and by H_2S in sewer gas.

"Corrosion Protection for Transcontinental Cable West of Salt Lake City, Utah," T. J. Maitland, *Corrosion*, June 1945, pp. 47-58:—Gives details of the manner in which the Bell System installed zinc anodes to protect the lead sheath of an underground cable stretching from Utah to the West Coast.

"Developing Magnesium for Cathodic Protection," Porter Hart and Yale W. Titterington, *Corrosion*, June 1945, pp. 59-69:—Describes The Dow Chemical Co.'s research to determine how magnesium anodes may be made to perform efficiently in cathodic protection of underground installations.

"Corrosion in Magnesium Alloys," James L. Erickson, *Light Metal Age*, July 1945, pp. 12-14, 40:—Review of nature and mechanism of Mg corrosion; effect of magnesium's corrosion resistance on its industrial applications.

"Procedure for Application (by welding) of Stainless Steel Strip-Liners to Refinery Vessels in the Field," K. E. Luger, *Petroleum Refiner*, May 1945, pp. 99-102.

"Antifouling Paints," G. H. Young, G. W. Seagren, and J. C. Zehner, *Ind. and Eng. Chem.*, May 1945, pp. 461-464:—Mechanism of accelerated corrosion under antifouling compositions applied to steel.

"Design Tips for Plastic Coating for Corrosion Resistance," Kenneth Tator, *Corrosion and Material Protection*, June 1945, pp. 14-17.

NEWS BRIEFS

A Cathode Protection Sales Dept. has recently been organized by the Magnesium Div. of The Dow Chemical Co. Manager of the new department is Arthur Smith, Jr., with headquarters in Dow's main office at Midland, Mich. The move was made to facilitate the specialized services connected with the use of magnesium anodes for cathodic protection of pipelines and structures.

Studies of condensate well corrosion now in progress under direction of the Natural Gasoline Association of America (*Chem & Met.*, Feb. 1945, p. 187) have been broadened to include three new investigations as the program enters its second year. The new research will be carried out at the University of Texas and will be directed by three staff members of the University's departments of chemistry and chemical engineering. Covering different but related phases of the over-all problem of determining the causes and possible cures for corrosion in high pressure gas wells, the new projects will be concerned with: (1) The study of surface films on well equipment, under Dr. Norman Hackerman; (2) varieties and concentrations of organic acids and other compounds, such as phenols, in waters taken from condensate wells, under Dr. H. L. Lochte; and (3) routine analysis of large numbers of water samples from both corrosive and non-corrosive wells, under W. A. Cunningham.

National Association of Corrosion Engineers announces that its 1946 Annual Meeting and Convention will be held in Kansas City, Mo., on May 7-9. The program is scheduled to include papers on corrosion mitigation in power plants, waterworks, transportation industries, buried communication lines, refineries, chemical plants and oil pipelines. In addition to the technical sessions, the three-day meeting will include an exhibition of various protective and corrosion resistant materials. NACE's address is 318 Southern Standard Bldg., 711 Main St., Houston 2, Texas.

CORROSION REPORTER

A fairly large firm of manufacturing chemists and pharmacists was consulted in the matter of materials of construction used by them to process a variety of food and pharmaceutical products. It is interesting to note that this company, by the nature of its products, must give serious attention to contamination, so that the materials of construction employed will in general yield high purity of product as well as adequate service life for equipment.

SULPHURIC ACID

Materials for handling sulphuric acid are not unusual. Acid above 66 deg. Be. is stored in steel tanks. Pipe lines and valves are also steel; valve trim is bronze. Pumps are of several varieties, LaBour alloy R-55 and Durimet predominating.

Concentrated acid is diluted to about 60 percent H_2SO_4 in homogeneously lead-lined tanks and the diluted acid is handled by Durimet valves, chemical lead pipelines, and Durimet or Type 316 stainless steel pumps. Later on in the company's manufacturing operation this diluted sulphuric acid plays a part in the production of such food acids as citric and tartaric which must pass rigid U.S.P. specifications as to lead content. The use of lead in the early stages of the process to handle dilute sulphuric acid does not give rise to enough lead pickup to give any difficulty in meeting these specifications in the food acids.

EDIBLE ACIDS

Citric, tartaric, gluconic and ascorbic acids are processed in considerable quantity for pharmaceutical and food use. Because of very low U.S.P. limits on lead content, there has been a trend, not only in this plant but throughout the industry, to get away from lead equipment in processing these materials.

This plant has completely replaced lead in favor of stainless steel or Monel. Stainless Type 316 is preferred to Type 304, though the latter will do if need be. In a reducing environment or in the presence of sulphides stainless Type 316 is preferable to Monel.

Otherwise, stainless steel and Monel are more or less interchangeable and are used for all customary equipment such as reaction vessels, agitators, pipelines, pumps, and the like. These handle any concentration of the acids in question and at any temper-

1. Horizontal inlet and discharge.

2. Horizontal inlet, vertical discharge.

3. Vertical inlet, horizontal discharge

4. Vertical inlet and discharge.

4 PORT DESIGN

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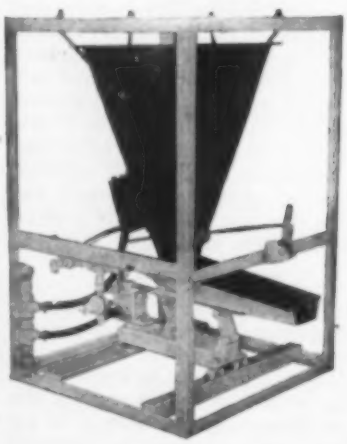

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ature up to about 120 deg. C. How the alloys would perform at higher temperatures has never been demonstrated since there has never been occasion to exceed 120 deg.

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Hydrochloric acid is used as a reagent in a great number and variety of reactions carried out in the course of normal operations. Commercial concentrated acid, about 35 percent HCl, is handled with rubber-lined pipe, valves, and storage tanks; a moderate amount of Saran pipe has been used. Pumps are Hastelloy C, glass, or rubber-lined.

All reaction vessels in which hot hydrochloric acid, which may be dilute or concentrated according to the reaction in progress, is employed are glass-lined. Fumes rising from the reaction vessels must be condensed; standard glass-lined condensers are used for the purpose. A few structural carbon condensers have been used in the same service and appear to give better heat transfer.

MERCURY COMPOUNDS

Earthenware subliming chambers are employed by this manufacturer in the production of mercurials. It has been reported that Hastelloy C can be used for this construction, though with what success is not known.

All equipment coming in contact with corrosive sublimate is glass-lined. Mercurial oxide is processed in wooden tanks, other equipment being of rubber-lined steel construction. White precipitate is handled in stainless steel, Type 316 being preferred.

ACTIVATED CARBON

This material must be sludged in water in order to pump it to the point where it will be used in process work. Years ago sludging was accomplished in earthenware vessels equipped with wood-paddle agitators.

Then, in an attempt to effect an improvement, a stainless steel tank and stainless steel agitator were installed. This was an economic fiasco. Both the tank and the agitator were corroded to uselessness in very short order.

Now, any equipment used to prepare or deliver activated carbon—including pumps, valves, and pipelines, as well as the sludging tank and its agitator—are made of rubber-covered or rubber-lined steel. The service record of equipment so protected has been excellent.

MOTOR TROUBLE

ANOTHER MANUFACTURER, a large producer of dyestuffs, reports difficulty in maintaining motors in his dye house where corrosive fumes rise from the dye-mixing tanks. Agitator motors are hardest hit and, depending upon the nature of the fumes to which they are exposed, may be expected to last from two to ten years. Acid fumes attack the starters too, the reaction on copper being so severe that occasionally a ferrule-type fuse has been pushed away from the fuse clip, loosening the clip and causing the motor to run single phase; a good practical solution has been to use corrosion-resistant cadmium plated clips. Of all the fumes encountered in the dye

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house, those from HCl and H_2SO_4 are by far the worst.

"The solution to the motor problem lies in the use of totally inclosed motors," states the company's electrical supervisor, "and, indeed, a replacement program was getting under way but was cut short by the war and material shortages. In the meantime, we have taken what protective measures we could to prolong motor life.

"We have tried covering the motors on vertical agitators with sheet steel, though it is questionable whether this is of much help, for it does not prevent the motor from sucking up fumes that rise from the tank. Metal parts still corrode and insulation still breaks down. We prefer glass insulation, by the way; it costs about one-third more than ordinary insulation, but lasts about three times as long.

"Our most successful weapon, and none too successful at that, is preventive maintenance. At the present, we make it a practice to remove the motors periodically, at least once a year, wash them with carbon tetrachloride, then paint the windings with a G-E lacquer called Liptol and bake them. But even this painting and baking is only partially effective because it is practically impossible to wash all the acid condensate from the motors. Imperfect as it is, however, the treatment seems to add about a year to the life of the motors.

"There is another course of action which we have considered but finally rejected. There are about fifty agitators to be driven, and we have thought of hooking them up to lineshafts so that the motors could be located away from the fumes. However, when a number of machines are driven from one motor, that motor must necessarily have greater capacity than the sum of the capacities for individual motors. And if each kettle does not use its full share of the motor's capacity, power is wasted. Also, with lineshaft transmission it would be almost impossible to effect the sudden changes in speed that are necessary in processing materials of widely different consistencies.

"It has been suggested that we might keep our individual drives, and still get motors away from fumes, if we were to mount the motors horizontally. It is true that such an arrangement would keep the ends of the motor out of direct contact with acid vapors, but the problem of hooking the motors to their agitators would be terrific; the idea has been abandoned.

"Ventilation has been proposed as a way out and, indeed, we very definitely plan to install such a system—but for the sake of the building itself, not the motors. Our feeling is that ventilation would do little good since motors, agitator motors at least, are in the direct path of fumes from the kettles, and vapors being drawn to ventilating ducts would still pass through and corrode the motors.

"Thus we have tried or considered everything we could think of to mitigate corrosion, and we have uncovered nothing to make us change our original conception that the only real solution is a completely inclosed motor. Therefore, just as soon as it is possible and practical, we will resume our replacement program and continue it until there are none but explosion-proof motors in the dye house!"

FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

AN INEXPERIENCED SALESMAN breezed in before "December Seventh" and tried to stampede us into hoarding leather belting. There was still a plentiful supply "for those who act quickly." He met the cruel rejoinder that when leather became scarce a substitute would be used. The implication of indispensability of either the pioneer article or of the substitute is of course an exaggeration. A belt is a flexible coupling between a driving and a driven mechanism.

There are some tough quarter-turn drives on centrifugal machines in our plant where leather has delivered more performance per dollar than has been extracted from any substitute ever offered. Where power is scarce and costly, the efficiency may require to be considered. As between flat belts of various materials and V-belts or steel chains, the refinery engineer does not have the facilities for determining efficiency. He assumes that a drive that performs perfectly for 25 yr. is efficient. The indication of inefficiency in a drive is in the wear of the materials, since it requires power to erode and destroy. However, a chemical plant having a large demand for process steam can produce power at so low a cost as to warrant some slight extravagance in return for high availability of the apparatus.

MANY RECORDS IN THE LOG provide useful comparisons. Typically: Two drives, consisting of 60-hp. motors, 12-in. endless leather belts and a pendulum tightener on the slack side to secure the wrap necessary to avoid slipping, carried on continuously around the clock. A modern hinged motor base might have answered instead of the tightener but this would not have provided more wrap. In ten years, eight endless leather belts of the best quality were consumed. The aggregate cost of these belts was $1,600. The V-belts which were then substituted cost $108 per drive. The first one failed after eight years, while the second, now nine years old, is still running. The first cost of the sheaves was $171.

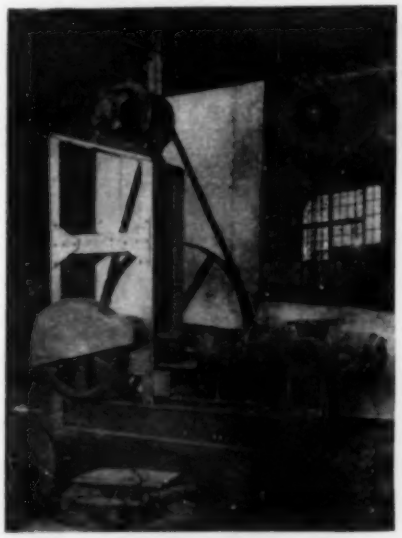
AFTER MANY YEARS we learned that the 5-ft. (crown-face) flywheel pulleys on the vacuum pumps and air compressors could be used "as is" with V-belts, the only addition required being sheaves on the motors and the discard of the tighteners. The average cost of the endless, short-center flat belts was $94.64 and the average life was six years, although two out of the nine drives lasted ten. The V-belts installed three years ago cost $51.16 per set and they are showing no signs of distress. The motor sheaves cost $41 each. An accidental shot of water and some steam from nearby tanks did some damage to the leather belts. This condition caused the V-belts to slip off the pulley but after protection by a tight guard, the drives performed perfectly.

The photograph shows one of many applications of V-belts to flat crown-face pulleys; these must of course be large enough in width and diameter to provide the necessary friction surface. In the case of the illustration the distance between centers was made unusually long to secure the required wrap for the motor sheave. It is not attractive to view but it produces profit. Incidentally, it is advantageous to support the motor on the same base that carries the machine that is to be driven.

A REFINED SUGAR ELEVATOR occasionally plugged because a neglectful operator fed jolts of overload. The elevator consisted of a 20-in. rubber belt with Salem buckets bolted on. Every time the elevator plugged, the flat belt at the head slipped off and thereby caused a shutdown of some of the packing equipment. And so this drive was replaced with a V-belt. For a long while everything was lovely. The belt pulled through ordinary small overloads. Then the old operator went to war and his successor opened the gate too far. The drive did not slip but the buckets pulled off the belt. Stronger bolts with larger heads were used. The next heavy overload provided a brand new experience. The V-belts slipped on the motor sheave, caught fire and spread a blaze to the dust on the elevator head and the ceiling beam flanges. Sprinklers promptly extinguished the fire but shut down the packing department for three hours and caused the engineer loss of a half night's sleep.

Exactly the same thing happened a year ago with a short-center flat leather belt that drives the distributing conveyor over the 1,000-ton raw sugar bin above the melter house. One Sunday night the operator dozed while the bin filled and the conveyor plugged. The fire spread instantly to the dust-laden parts but was controlled by the sprinklers. The loss included the melting of 50 tons of raw sugar but repairs were completed before the bin had run out to process.

A RAW SUGAR ELEVATOR was installed about 32 yr. ago having two strands of 9-inch-pitch steel chain straddling the buckets for "perfect discharge." To avoid excessive width of casing, the builder used a head wheel having only nine teeth. As this nine-sided polygon revolved, it produced nine jolts in the chain for every revolution. The drive was a rigid train of gears and chain back to the motor. Under these circumstances the elevator chains had a life of only two years. A leather belt from the motor to the first jack shaft cushioned the jolts and made the chain



Magma pump driven through four V-belts. Motor pulley must be grooved but crown-face flywheel pulley need not

last longer. At the first opportunity, the 9-inch-pitch chain was replaced with a pitch of 3.075 in., which had a life of ten years. The leather belt with its cushioning quality was retained. Also, it slips off occasionally, protecting against overload.

WHEN REPLACEMENT was required of these short-pitch chains, our manufacturer recommended chain of the same design, but improved by a heat treatment which had just come out of the research laboratory. The first Sunday's inspection disclosed some cracked links, which were replaced. On the second Sunday, ditto. The manufacturer's engineer was greatly concerned. His metallurgist blamed their limited experience and so the company without delay fabricated new chains and delivered them free of charge with their apology. In a few weeks the weak links in the old chains were weeded out and we got eight years use out of the chains for the cost of the labor of installation. The new chains were installed in the duplicate second elevator and after twelve years are still running.

PARENTHETICALLY, our works has usually selected suppliers of mechanical devices as family doctors are selected, giving preference to neighborhood manufacturers—other things being equal. The quantities in each classification are voluminous enough to attract a single supplier and to inspire extra effort when emergency calls for it. When we built our Florida Mill in '23, the plans called for

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an item of cane carrier chain amounting to about $6,000. The Purchasing Agent elected to call for competitive bids and awarded the order to a newly organized shop above Detroit. The principal impulse in this shop was a highly regarded engineer who had spalled off the organization of our own customary supplier located within cruising radius of our service truck in Philadelphia. When the new chain got into action there were frequent failures and we called on the manufacturer to make good under his guarantee. "Imagine our surprise" when the answer came from our supplier in which he informed us that he had taken over the assets of the Michigan shop and had now entered an order for the replacement without charge to us.

TWO BLADES FAILED in a 600-hp. turbine last summer. This is one of 19 mechanical drive turbines furnished by the same manufacturer. We installed the spare wheel, and our service truck delivered the old one to the builder's shop with an order to repair on the basis of time and materials. We did not know the reason for the failure after over two years of service but suspected a slug of water. A few days later the turbine builder's engineer called up. "Dan, our engineers have determined that that blade failure was due to weakness of our design. Our shop will furnish you a new and stronger wheel without charge!" In the chronicler's 30 years of experience in buying from neighborhood machinery builders, he has never been called upon to make good on a manufacturer's defective work. The genus, American machine builder, is a grand and glorious person!

PATRIARCH JOHN DYMOND, famous sugar grower and manufacturer, and the founder and editor of that great and informative *Louisiana Planter*, announced editorially in 1888, "The mistakes we all make in sugar have been made by hundreds of others before us and if we had a record of those mistakes, we might have avoided them. The successes we have made, have been made by hundreds of others before us, and if we had a record of them, we might have attained our successes years earlier."

ONE OF KANSAS' sorghum mills reported as of 1889 to the *Planter* that a woman had been installed in the laboratory as "polarizer." This stirred up several months of vigorous correspondence in the Association's journal. It called forth the entire gamut of emotions—consternation, chagrin, elation, hope, hate, and love. On the other hand Planter Thoms, of good repute, who owned a Louisiana plantation and sugar mill, deposeth and saeth (likewise as of 1889), "If the chemists have made any improvement in the manufacture of sugar in Louisiana beyond what was done 40 years ago, I should like to know where it is. The increased yield of sugar per ton of cane comes from fertilizing and from new, improved agricultural implements and from heavy mills—and not from improved methods of manufacture."

Brother Thoms, as may be surmized, was a dirt farmer. His plant reported a yield of about 100 lb. of sugar per ton of cane. After a few years of missionary work,

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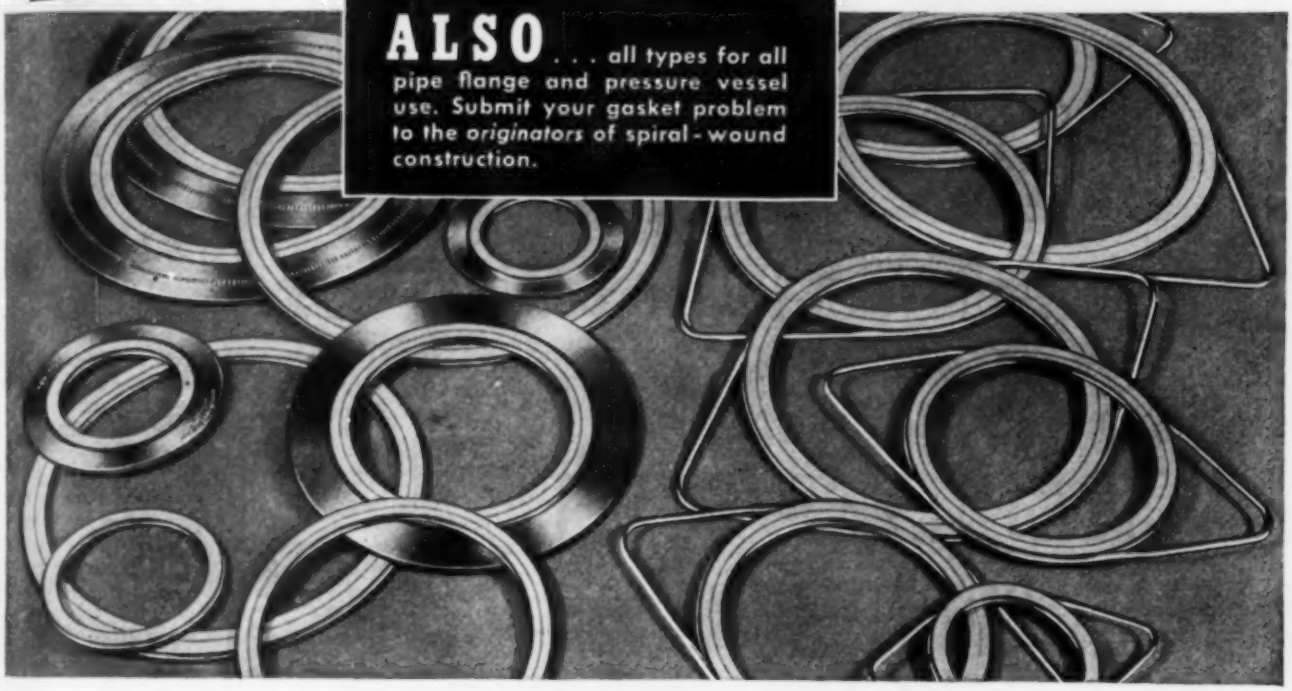

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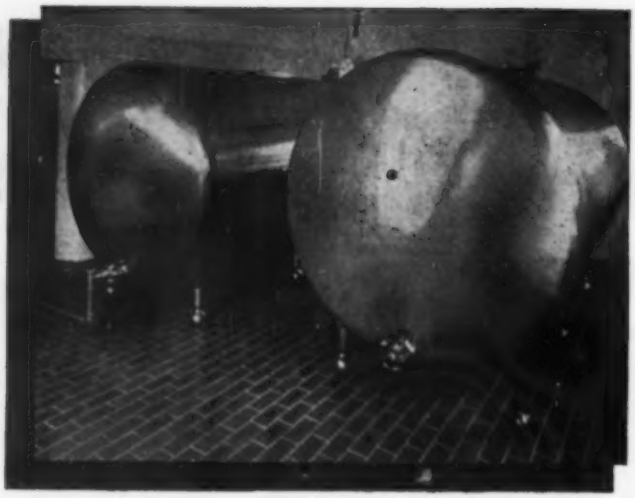

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among the planters by Chemists Guilford Spencer and W. C. Stubbs, chemists became standard accessories in the mills and even Bro. Thoms' extraction increased to 200 lb. per ton of cane.

A PIPE FITTER left the works in chagrin after three weeks of employment. His goal had been the distillery, where he thought alcohol flowed freely and openly. Temporarily he was willing to exercise patience and restraint in a job in the refinery in expectation of early transfer to the place where affluence awaited a man of cunning like himself. As he left he confided, "A dollar an hour; that ain't no dough; that's cabbage!"

THE VERSATILITY of sugar tramps met its match with a grandfathers clock that arrived from the States at the Mexican sugar estate of Los Mochis. The clock was shipped dismantled and the parts separately packed to avoid injury to the delicate mechanism while traveling over the washboardy road from the North. The manager in his excitement unpacked the clock and scattered the parts in bewildering array over the library floor.

There was no clock maker within gunshot of the plantation. The sugar mill staff was canvassed but none admitted skill in the art. However, it was known that Emile Zitkowski's grandfather had been clocks out of wood in the Old Country and it was hoped that the aptitude might have descended from the old man to the grandson. Accordingly, the manager arranged a dinner for the staff. After coffee, the boys proceeded to the library with Emile confidently out in front. When he contemplated the complexity of gears, springs, weights, and cuckoo, a chill came over him. He knit his brows and announced that, after all, the art of clock construction had died with his grandfather.

THE WIZARD has an attaché in the electric shop who started from scratch 2? yr. ago. The rest of the class has long since passed him. Some graduated to responsible jobs in other shops. One of the old timers paid us a visit recently and greeted the attaché with the question, "What are you doing now?" The answer was, "Oh nothing, just laboring; same as usual!"

HOWARD SMITH'S building included a sizable amount of plumbing which was in the hands of a grasping plumber. Howard decided that on one of the floors there were a dozen more fixtures than he needed but he hesitated to make a direct request for the price for the omission lest there should be a sudden drop in the market. Howard therefore called the plumber into conference, and while the chronicler was present, notebook in hand, he asked the plumber how much he would charge for twelve more fixtures.

The plumber overreached himself exactly as Howard had anticipated. Quick as a flash, Howard said, "After all, I want those twelve fixtures on the mezzanine floor omitted. Dan, make a note of the amount and deduct it from the plumber's contract. Let's go!" The plumber was, of course, entitled to his overhead in

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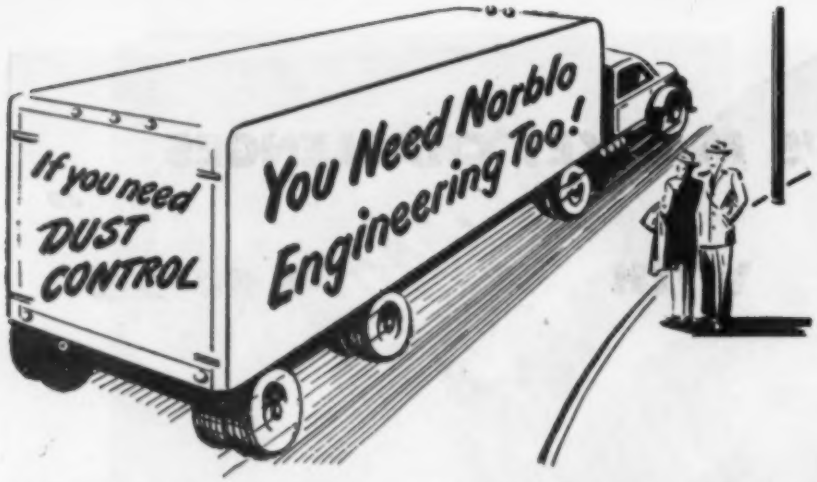

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reduction of the amount of the work, but his attempt to take excessive advantage and Howard's quick wit left him speechless.

As this work got underway, we were just finishing a job in "North Beach," where masons of Italian extraction predominated. Smith's building site was in the "mission," which was the special preserve of the Irish. We made the faux pas of transferring the "Eyetalians" into the Irish territory. A gallery lined the sidewalk and now and then some arrogant partisan tore off the masons' chalk line which was stretched across the lot. Without affecting notice of the heckler, we repeatedly replaced the line. However, our crew was growing fidgety under the epithets from the sidewalk. A braggadocio, exasperated because of his inability to provoke the spark that would have brought the pack down on the lot, announced that he was going to beat up the — — so-and-so!

The chronicler, then 100 ft. away, backed towards the sidewalk, watched for the prospective assailant's shadow, and then at the tactical moment, swung around and delivered a beautiful knockout to the jaw that would have done credit to John L. Sullivan himself! Then we helped the ruffian to his feet, handed him his cap, and asked him if he had enough. He shook hands and departed, and with him the entire mob, thereby attesting an established mass psychological fact.

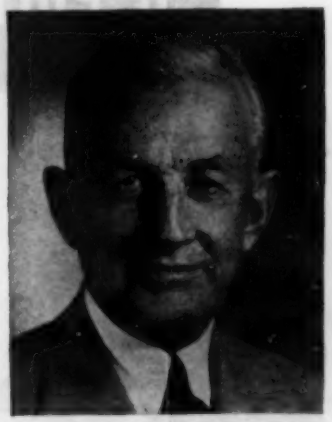
THE HANDIWORK of Bro Reeve, of Alphons Custodis, the famous builders of tall chimneys, is scattered all over the world. One of his reinforced concrete chimneys, 400 ft. high, was threatened by acid fumes. The material readiest to hand for lining and yet the last to come to the mind of a layman is wood. And so Reeve built a lining of three-inch fir planks laid flat, loghouse fashion, doweled and spiked. The result was effective but he had to go back a few months later to add 4 or 5 ft. on top to make up for shrinkage. On another occasion he erected a 300 ft. chimney on a foundation built by the owner on coral rock. The chimney began to lean and when it reached ten inches from the plumb line he went back and pumped 100 cu. yd. of concrete into the coral cavities under the foundations.

THE SUNDAY CLEANUP leaves several tons of "smear" sugar which is accumulated in open-top barrels on the third floor. On Monday morning, before the station becomes active, the factotum there is required to roll the barrels promptly to the raw sugar melter 100 ft. away. This task aggravates that Monday morning indisposition. Among the repossessed accumulations there are also a few barrels of powdered sugar, the return of which must be spread over two shifts because of its conditioning with 2 percent of cornstarch. Accordingly the wiley "polander" covers the smear barrels with a blanket of powdered sugar and sits back while the labor is transferred to the next shift. This procedure exhibits a certain intelligence. However the perpetrator thinks he is smarter than anybody else and grows bolder till he falls into a trap.

NAMES IN THE NEWS

E. G. Crum

R. E. Chaddock



W. M. Rand

Edward G. Crum, plant manager of the Hercules Powder Co., Cellulose Products plant at Parlin, N. J., has been appointed assistant general manager of the Hercules Cellulose Products Department in Wilmington. He succeeds **John J. B. Fulenwider** who was appointed general manager on August 31. Mr. Crum also will continue to discharge the duties of manager of the Parlin plant for the present.

Otto F. Sieder, formerly chief of the industrial construction division in the office of the Chief of Engineers of the War Department, has been named vice-president and general manager of The H. K. Ferguson Co., engineering and construction firm.

T. Earl Jordan has joined the staff of the Institute of Textile Technology, Charlottesville, Va., as a research associate. Dr. Jordan was formerly with the Barrett Division of the Allied Chemical and Dye Corp., Philadelphia.

Howard F. MacMillin, formerly president and general manager of the Hydraulic Press Manufacturing Co., has become associated with Arthur D. Little, Inc., Cambridge, Mass., where, for the present, his work will be confined particularly to conversion to peacetime uses of important war-developed equipment and processes.

Eric J. Hewitt, Florence E. Wall, and **Charles P. Shillaber** have joined the staff of Ralph L. Evans Associates, Consulting Chemists, New York.

Leonard A. Yerkes has resigned as general manager of the Rayon Department of E. I. du Pont de Nemours & Co. where he has directed the development of the company's synthetic fibers business from its inception in 1920.

M. E. Cody has been appointed price executive of the Paper and Paper Products Price Branch of the OPA to succeed **J. R. Atwater** who has resigned to return to private industry.

Richard E. Chaddock has joined the Research Department of Hercules Powder Co. as technical assistant, where he will work on process problems. Dr. Chaddock is a chemical engineering graduate of the University of Michigan.

T. C. Gary, manager of the Design Division of the Engineering Department of the Du Pont Co., has been named Department Engineer. **M. F. Wood,** manager of the Construction Division, is now manager of the Design Division, and **F. H. Mackie,** who was manager of Construction of Government Plants for War Production, has been made manager of the Construction Division.

Kenneth Sutherland has joined the staff of Bjorksten Laboratories, Chicago, as a chemist. He was previously associated with Turco Products, Inc.

Herbert B. McKean, formerly with the U. S. Forest Products Laboratory has been engaged by the Timber Engineering Co., Washington, D. C., as assistant to the director of research.

Harley C. Lee has rejoined Basic Refractories as vice-president and technical director after having been in charge of the technical department of Basic Magnesium.

Eugene C. Anderson has just been named director of the New Mexico Bureau of Mines & Mineral Resources at Socorro, succeeding **A. B. Hahn,** who resigned to enter business. Mr. Anderson was formerly chief engineer of the Carlsbad potash properties of International Minerals & Chemical Corp. Later he was manager of this firm's phosphate division at Drummond, Mont.

Axel Ekwall, chemical engineer, who was in this country during 1941-43 as a fellow of the Swedish-American Foundation studying pulp and paper is now here for a year as technical attaché of the Swedish Legation.

William M. Rand has been elected president of Monsanto Chemical Co., succeeding **Charles Belknap** who will continue with the company as chairman of its executive committee.

Marion Cecile Joswick, prize winner in the fourth annual science talent search, entered the Polytechnic Institute of Brooklyn early in October to undertake a course in metallurgical engineering, under a four-year Westinghouse Science Scholarship.

Rolf Thelen, who has been closely associated with the development of the U. S. Forest Products Laboratory since 1909, has retired. He has been chief of the laboratory's division of timber physics for the past 26 years, and will be succeeded in the post by **Raymond C. Rietz,** a staff member since 1928.

W. E. Gladding, manager of the nylon plant at Martinsville has been named manager of the Seaford nylon plant, and **Cantwell Clark,** manager of the Yerkes rayon plant at Buffalo, succeeds Mr. Gladding at Martinsville.

Burton L. Kassing, for the past twelve years paper mill superintendent of the Hammermill Paper Co., Erie, Pa., has resigned from that position to accept a professorship in the Department of Pulp and Paper Manufacture at the New York State College of Forestry, Syracuse University. He will succeed **W. Oury Hisey** who resigned to undertake consulting work in Johannesburg, South Africa.

Henry C. Speel, formerly with the Atlas Powder Co., Wilmington, has joined the Research Department of General Mills, Inc., where he will work as development engineer on new chemical products.

David R. Wiggan, manager of technical service for the Cellulose Products Department of Hercules Powder Co. has gone to Europe where he will visit Hercules branch offices and customers in England,

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Sweden, Norway, Holland, Switzerland, Belgium and France, and will tour European plants engaged in the production of cellulosic materials to study any technical improvements or uses of cellulose materials which have developed in Europe in the past six years.

Frederic W. Jung, specialist in chemical and fuel technology who has been conducting research in gas for the Chilean government, has joined the staff of the Midwest Research Institute, Kansas City, Mo.

J. F. M. Taylor, formerly vice president of manufacturing in Shell Oil Co., Inc., San Francisco, Calif., has now opened offices as a private consultant in San Rafael, Calif.

Robert A. Millikan has retired as administrative head of California Institute of Technology, Pasadena. He will continue as vice president of the board of trustees, and will assist in public relations work and institutional development. He also plans to devote considerable time to research and writing.

Morton I. Dorfan has been appointed manager of the dust and fume engineering division of American Foundry Equipment Co., Mishawaka, Ind. Included in the duties of his new position will be supervision of the company's research and engineering activities.

C. E. Waring has been appointed by the Davison Chemical Corp. as technical assistant to the president. Until recently his duties were supervisor of Frigidaire's main chemical, metallurgical and process engineering laboratories.

John J. B. Fulenwider and **J. B. Johnson** have been elected directors of the Hercules Powder Co.

John Rich, chemical engineer, formerly with the Newton Falls Paper Co., is now manager of the coating department of the Plastics Film Corp., Plainfield, Conn.

W. S. Gillam, professor of agricultural chemistry at Purdue University has joined the staff of the Midwest Research Institute, Kansas City, where he will specialize in research in soils, plant nutrition and analytical services.

Benjamin M. May has been named general manager of the Rayon Department of E. I. du Pont de Nemours & Co. He succeeds **Leonard A. Yerkes** who has retired. Mr. May has been with the du Pont organization for 42 years.

Henry B. Hass, professor and head of the Department of Chemistry, Purdue University, received an honorary degree of Doctor of Laws from the University of Chattanooga, last month.

Mahlon A. Combs has been appointed assistant secretary of the Industrial and Commercial Gas Section of the American Gas Association. The position to which Mr. Combs has been appointed is a newly

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created post made necessary by the increased scope of industrial and commercial gas problems and activities.

W. Laird Stabler, manager of the Du Pont nylon plant at Seaford, Del., for the last four years, has been named manager of a newly established personnel and industrial relations division in the Rayon Department of E. I. du Pont de Nemours & Co.

E. K. Stevens has returned to his position as associate manager of the Exposition of Chemical Industries, after three years as a major in the Production Division, ASF, in Washington.

A. J. Flebut has recently been made western manager of the Niagara Sprayer & Chemical Co., Inc., a subsidiary of Food Machinery Corp., San Jose, Calif. Mr. Flebut's headquarters will be in Richmond, Calif.

Ronald D. Gibbs, formerly assistant to the executive vice president of Union Oil Co. of California, Los Angeles, has been elected a vice president of that organization. Mr. Gibbs will maintain offices at the headquarters in Los Angeles.

Philip G. Murdoch, associated with Shell Oil Co., Inc., San Francisco, for many years, has been appointed professor of chemical engineering at the Texas A. & M. College. Dr. Murdoch will conduct graduate courses and research investigations.

Raymond E. Kirk, head of the Department of Chemistry and dean of the Graduate School of Polytechnic Institute of Brooklyn, has been appointed chairman-elect of the New York Section of the American Chemical Society.

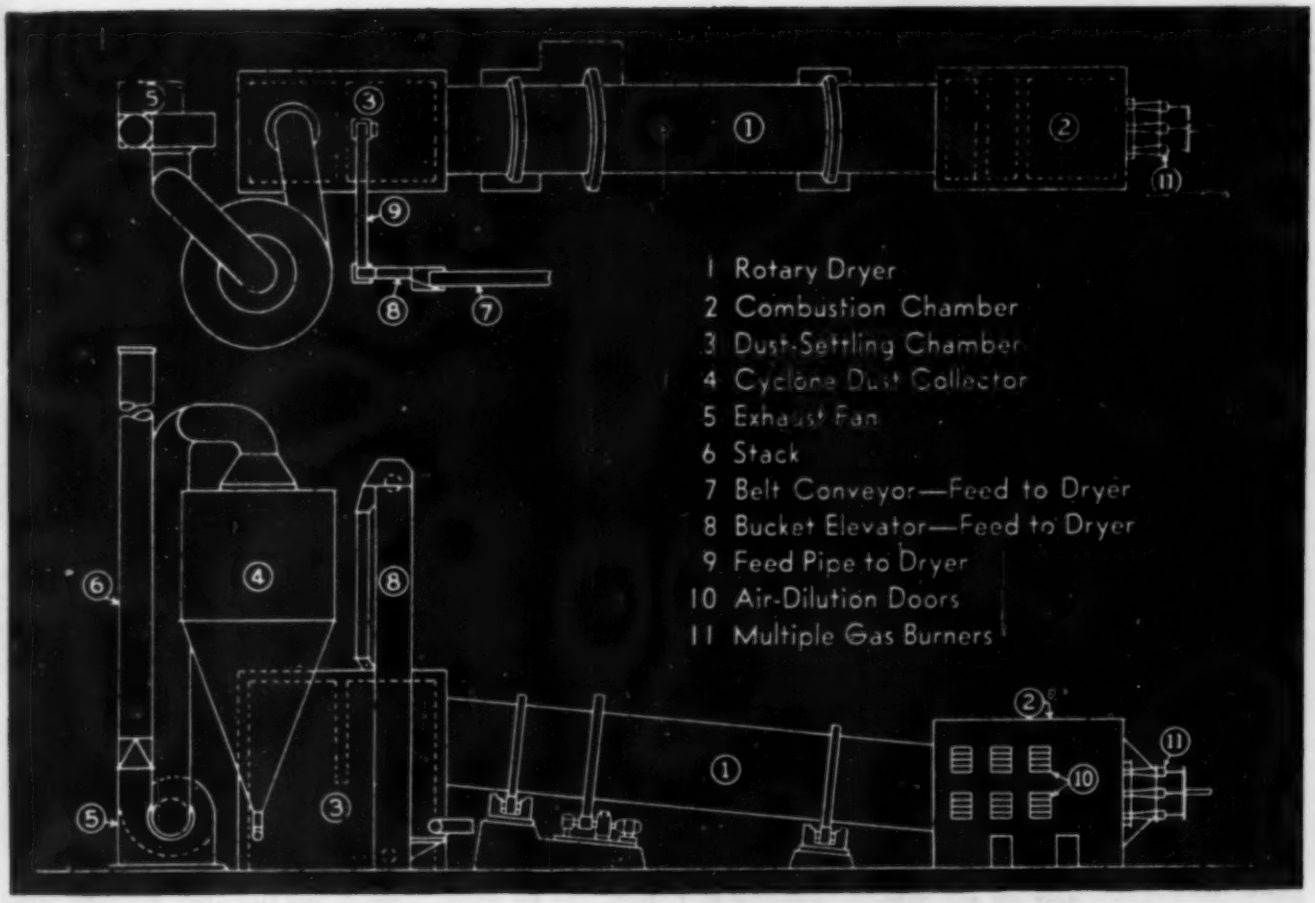
H. J. French has resigned as assistant director for Raw Materials and Facilities of the Steel Division, WPB, Washington, and has resumed his duties as assistant manager of the Development and Research Division of The International Nickel Co. Inc. of New York.

William M. Murray, Jr. has joined the staff of Southern Research Institute, Birmingham, Ala., to take charge of the work in analytical chemistry. He was formerly with the General Electric Laboratories at Pittsfield, Mass.

Reuel C. Stratton has resumed his post as supervising chemical engineer of the Travelers Insurance Co., Hartford. Lieutenant Colonel Stratton, for the last two years, has acted as special assistant to the Director of Safety, Office of the Chief of Ordnance.

F. A. Rohrman has been appointed associate professor of Kansas State College. Major Rohrman will take up his new duties as soon as he is released from the Army.

Albert H. Cooper has been appointed professor of chemical engineering in the College of Engineering at the University of Kansas. He will also be chairman of his department. Dr. Cooper has been on



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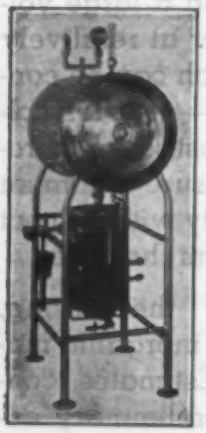

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leave from Virginia Polytechnic Institute during the past several years while he was a captain in the Chemical Warfare Service. Since last February he has been in charge of the Baltimore plant of the U. S. Industrial Chemicals Co.

Isaac Fogg has been elected president of the Atlas Powder Co. **Leland Lyon** has resigned as president and as member of the Executive Committee, but retains the post of chairman of the Board of Directors.

J. R. Frorer, formerly manager of the Polyalcohol Division has been appointed general manager of the Industrial Chemicals Department of the Atlas Powder Co. —succeeding **M. J. Creighton** who has been elected vice-president.

Harold G. Houlton has been promoted to the position of manager of technical service of the Votator Division of the Girdler Corp., Louisville, Ky. Before joining Girdler two years ago, Dr. Houlton was with the Process Development Dept. of Proctor & Gamble.

Charles S. Williamson, Jr., head of the School of Chemical Engineering of the Tulane University of Louisiana for the past 28 years, has opened offices in New Orleans to continue chemical, and chemical engineering consultation.

R. F. Boltz has been named manager of the duPont, Wash., commercial explosives plant of E. I. du Pont de Nemours & Co. to succeed **F. T. Beers**, who has retired. Mr. Boltz was formerly manager of the Alabama Ordnance Works.

P. S. Cushing has been named by E. I. du Pont de Nemours & Co. as manager of the Louviers, Col., commercial explosives plant of this firm. Mr. Cushing succeeds **A. S. Albright**, who has been transferred to Birmingham, Ala.

M. L. Arnold, chief engineer of the gas department of Richfield Oil Corp., Los Angeles, was recently elected president of the California Natural Gasoline Association. Mr. Arnold was the director of the Association in 1940 and a vice-president in 1944.

M. W. Kibre, assistant manager of the gas department, General Petroleum Corp., Los Angeles, Calif., has been elected vice-president of the California Natural Gasoline Association. A University of California chemistry graduate, Mr. Kibre has held numerous responsible posts in General Petroleum Corp.

OBITUARIES

Leo Altenberg, department sales manager of the Calco Chemical Div., American Cyanamid Co., died in New York, September 13.

Herman M. Partridge, 42, assistant professor of chemistry and assistant to the head of Washington Square College of Arts and Sciences, New York University, died in New Hampshire, September 17.

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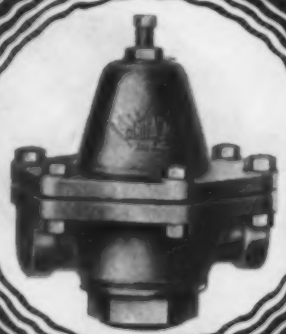

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DECATUR ILLINOIS

INDUSTRIAL NOTES

Wilmotte Laboratory, Inc., Washington, D. C., of which Raymond M. Wilmotte is director, recently opened a branch laboratory at 236 West 55th St., New York 19. Paul H. Crago is in charge of the new branch assisted by Hugh J. Cameron. An association has been formed between the laboratory and Jackson & Moreland, consulting engineers.

Portable Products Corp., Pittsburgh, has appointed E. D. Wacker general manager of its C. J. Tagliabue division, Brooklyn, N. Y. Mr. Wacker served as general manager for the last eight years and has been associated with Tagliabue for 22 years.

The Chicago Bridge & Iron Co., Chicago, has opened a sales office in the Healey Bldg., Atlanta, Ga., with H. F. Stearns in charge.

Dow Chemical Co., Midland, Mich., has formed a cathodic protection sales department for the magnesium division. Arthur Smith, Jr., has been appointed manager and will make his headquarters in the main offices of the company. H. A. Ellis will continue to handle magnesium sales in the St. Louis territory.

Lapp Insulator Co., Inc., LeRoy, N. Y., has acquired exclusive rights to the Pulsafeeder chemical proportioning pump formerly marketed by Wilson Chemical Feeders, Inc., Buffalo. Lawrence F. Wilson who developed the pump, Victor H. Leipold, service engineer, and other Wilson personnel have become affiliated with Lapp.

Taylor Instrument Companies, Rochester, N. Y., has made Raymond E. Olson general sales manager to head up domestic and foreign sales activities. Ralph E. Clartridge succeeds Mr. Olson as sales engineering manager, Frank S. Ward is now industrial sales manager and W. Maben Griffith takes on additional duties as commercial sales manager.

Visual Training Corp., Detroit, has changed its name to Florez, Inc. Genaro A. Florez founder of the company continues as president and chairman of the board.

Lukens Steel Co., Coatesville, Pa., has named William C. Simpson manager of sales for its subsidiary, Lukenweld, Inc. Since 1943 he had been manager of direct sales for the steel company and previous to that had been manager of the sales office in Pittsburgh.

The Davison Chemical Corp., Baltimore, has formed a new engineering division headed by E. B. Dunkak. His assistants are J. C. Albright, head of the consulting engineering section, R. S. Van Note, head

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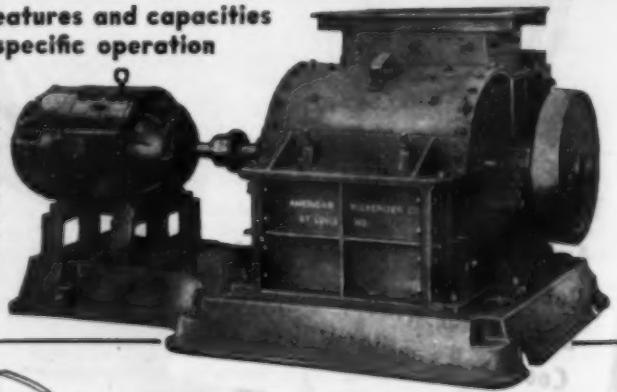

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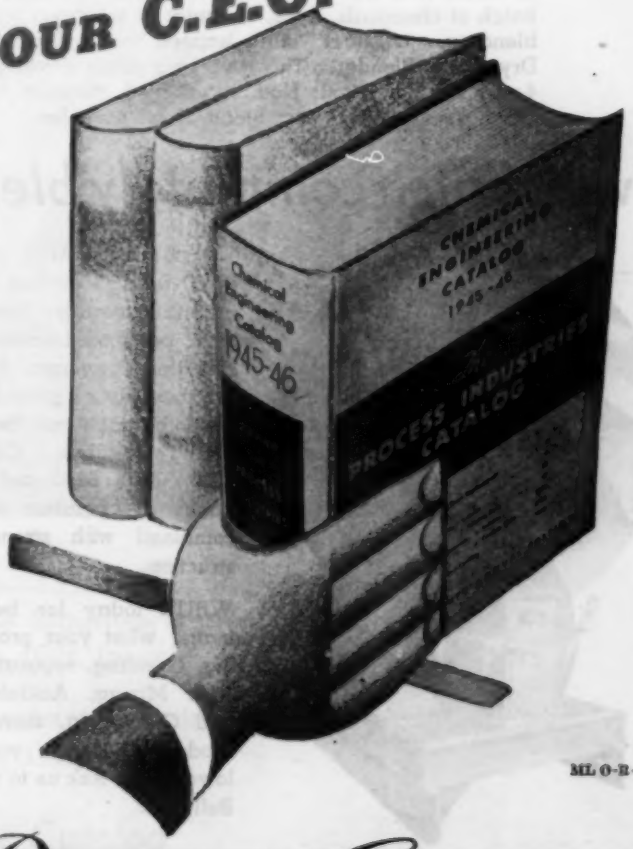

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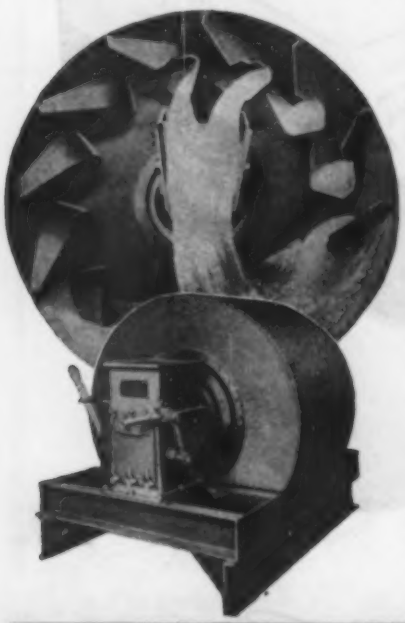

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of the equipment section, and Kenneth H. Van Valkenburg, head of the process engineering section.

Thermoid Co., Trenton, N. J., has appointed Oscar Nuss district manager for southern California, New Mexico, and Arizona with headquarters at the company's plant in Los Angeles. Walter B. Chick has been appointed district manager in the northwest Pacific Coast area with headquarters at the company's branch office in San Francisco.

Owens-Illinois Glass Co., Toledo, has made Eugene F. Bertrand sales manager for the drug and chemical industries divisions. Mr. Bertrand recently rejoined the company after serving on the War Production Board.

Worthington Pump and Machinery Corp., Harrison, N. J., has elected Hobart C. Ramsey, executive vice president of the company, to the position of president of its subsidiary, the Ransome Machinery Co. at Dunellen, N. J.

Bailey Meter Co., Cleveland, has appointed W. E. Dueringer assistant sales manager and H. E. Weaver proposition department manager. Both men have been associated with the company for more than 25 years.

International Minerals & Chemical Corp., Chicago, has announced the selection of Dr. Arthur P. Hellwig as director of sales for the Amino Products food and pharmaceutical division. Dr. Hellwig had been sales manager of the specialty products division of American Maize-Products Co. and president of its subsidiary, C. M. Armstrong, Inc.

Latrobe Electric Steel Co., Latrobe, Pa., has opened a district sales office at 10 High St., Boston 10, with Robert S. Ross in charge.

Gustave T. Reich, Philadelphia, has opened offices as a consulting chemical engineer in the Packard Bldg. For the last 15 years Dr. Reich has served as technical director of the Pennsylvania Sugar Co.

American Steel and Wire Co., Chicago, announces that H. A. Squibbs, formerly assistant general manager of sales at Chicago, has been made assistant to sales vice president and C. Gilchrist has been promoted to the position vacated by Mr. Squibbs.

The United Tube Corp., Cleveland, has opened a new plant at 2134 West 53rd St., in that city.

The Edward Valve & Mfg. Co., East Chicago, Ind., has appointed Leatherman & Mertz, Book Bldg., Detroit, as its representative for all of Michigan excluding the upper peninsula.

Republic Flow Meters Co., Chicago, has named Rowland B. Drescher to succeed the late Carl E. Pritchett as manager of the Pittsburgh district. Headquarters are in the Investment Bldg.

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Plain carbon and corrosion- and heat-resisting alloy steel tubes and parts produced to close specifications from steel melted in electrical furnaces under rigid production controls.

Radiant Furnace Tubes, 27% Chrome—13% Nickel. Butadiene Furnace Tubes with 25% Chrome and 20% Nickel, 18-8 Stainless and other alloy steels have also been supplied. All tubes cast in 16-ft. lengths.

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THE ATOM BOMB SECRET

In a few years every nation in the world will know how to make atomic bombs. Attempts either to keep the secret of atomic energy or to outlaw the bomb are doomed to failure. Only a powerful world organization can enforce peace.

No one is wise enough to predict or even guess the future of nuclear power. While we should tell nobody what we have learned about atomic energy for the present, it is the purest folly to imagine that such information can be kept "secret" very long. Scientists all over the world will soon work out the problem in their own way. It is a primary fact of science that oftentimes the only clue which a scientist needs to solve even the most difficult problem is the definite knowledge that some other scientist has solved it. In other words, we can assume that within a very few years every nation will know how to make atomic bombs. Any other assumption would be highly dangerous.

Attempts to outlaw the bomb would be another bit of folly. Any group with the power to prevent the use of the atomic bomb would have to have power sufficient to prevent war. That should be the goal. It is no longer a matter of idealism but one of simple survival.

The atomic bomb has made war too dangerous for the human race. An organization powerful enough must be maintained to enforced peace. The atomic bomb must not be used again. This does not mean that it should be outlawed by some international meeting of well meaning old ladies of both sexes. It must be abolished in the only possible way, namely, by the abolition of war.

Up to August 6 a good share of the human race looked upon war in a more or less fatalistic way, and felt that it was hopeless ever to stop war. Human beings seem born to fight. Much effort was spent and wasted on efforts to promote what was fatuously called "civilized warfare." At long last we recognized that there can be no such thing as civilized warfare. The two words simply do not go together.

Indiscriminate destruction of non-combatants and women and children is never civilized but, for that matter, dashing in a man's head with a stone ax in the good old days of the cave dwellers was

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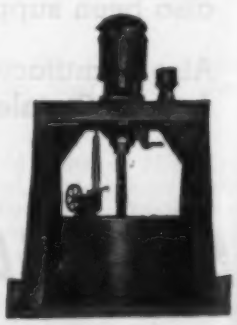

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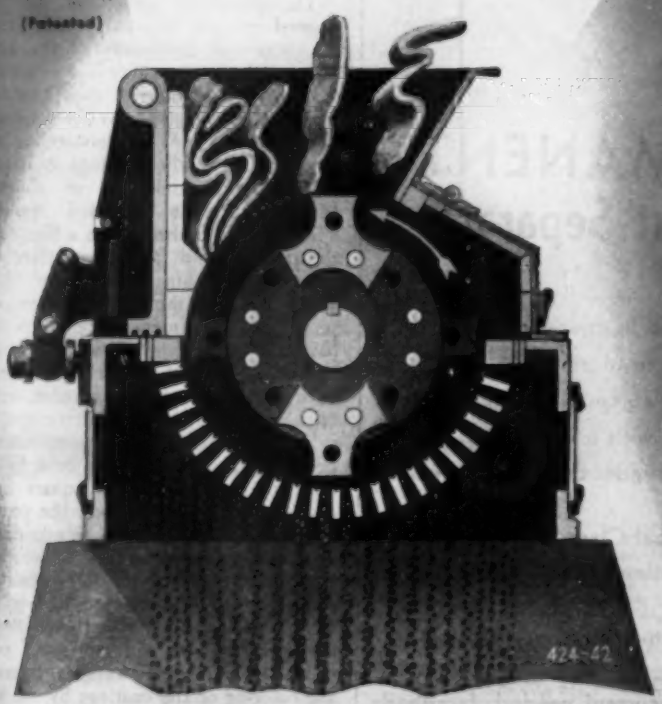

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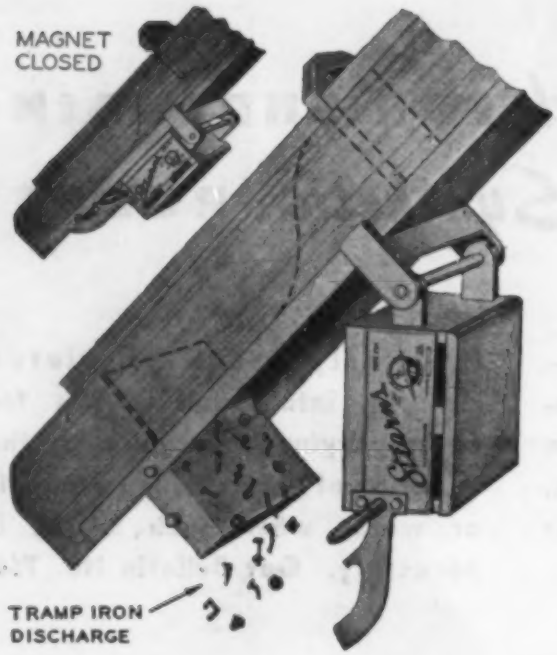

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not civilized either. The point is that we have now stimulated ourselves to a point where we must not have another war.

Frank C. Whitmore, Willard Gibbs Medal recipient, before Chicago Section, American Chemical Society, Sept. 28, 1945.

ANODIC TREATMENT OF ALUMINUM

ANODIC coatings on aluminum have gained an important position in the field of modern metal protection. During the war, they were used extensively to protect aircraft and military materiel against the hazards of unusual and severe service conditions. In the peace we are working for, they promise to make aluminum more useful by providing hard, wear-resistant surfaces readily cleaned, surfaces which help protect against corrosive attack, which present an attractive appearance, and which may be given an endless variety of color for many applications. These anodic coatings are substantially aluminum oxide, 0.1 to 0.6 mil in thickness, and are made by electrolytic oxidation in solutions such as sulphuric, oxalic or chromic acid.

The protective powers of the coating depend in an important way on the thickness and continuity of the coating. When aluminum alloys are anodically coated, certain alloying constituents may be selectively attacked, to the detriment of the continuity. An understanding of the structure of anodic coatings is important for it permits selection of alloys best adapted for the intended application. These anodic coatings have a fine porosity, the pores extend from the surface of the coating to a thin barrier layer of oxide about 0.00003 mm. in thickness at the surface of the metal. These pores are too fine to be viewed with the optical microscope and their presence and behavior have been demonstrated by other methods. Now, with the electron microscope, visual evidence of their size and distribution has been obtained. There may be a billion or more of these pores per square inch of coating. Their effects upon the protective powers of the coating can be minimized by a sealing operation, several of which have been discovered. These pores admit aqueous solutions but are too fine to admit solid particles. They give the coating high adsorptive power and advantage of this can be taken in many ways, as for example, the coloring of the coatings by dye adsorption.

Junius D. Edwards, Aluminum Co. of America, before Cleveland Section, The Electrochemical Society, Cleveland, Sept. 22, 1945.

TARIFF COMMISSION REPORTS

No OTHER industry can match the rapid strides and startling development that mark the chemical industry. This progress holds such significance for the security of this Nation and for the welfare of its people that both industry and government must periodically obtain the "vital statistics" of this great industry to find out what it is doing and where it is going.

The Tariff Commission has a special interest in such statistics in chemicals

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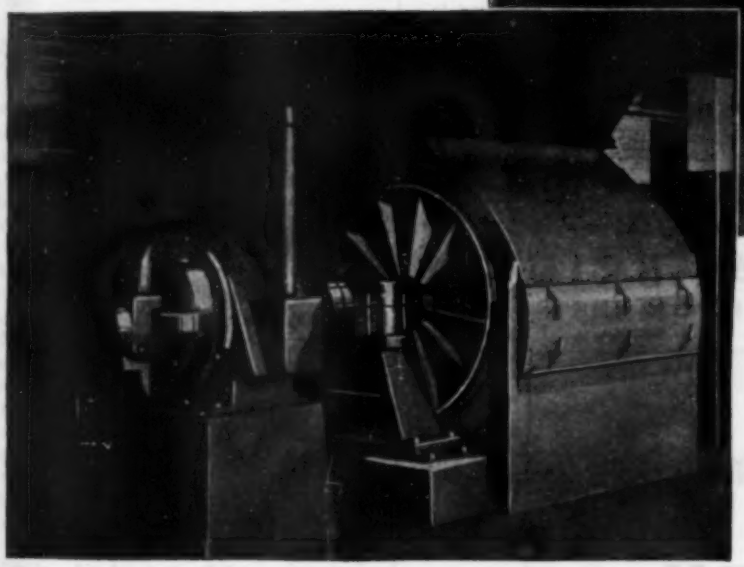

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since, as a part of its regular activities, it has collected and published data on synthetic organic chemicals for nearly three decades.

During the war the Commission has released jointly with the War Production Board in the Facts for Industry Series 6-2, data on production, consumption, and stocks of about 25 organic chemicals. Although these data were collected and compiled monthly or quarterly by the Commission on more than 300 organic chemicals, very few of them could be published because of their confidential nature. In the postwar period this series will be replaced, if approved by the Bureau of the Budget, by a monthly and quarterly release of production and sales data on about 50 synthetic organics.

By far the most important recurring publication on chemicals issued by the Commission is the annual report, "Synthetic Organic Chemicals, United States Production and Sales." The 1944 report, soon to be released, will be the twenty-eighth consecutive one on this subject.

Present form of the report, including the broad classification by use, into which the data in the report are divided, is determined partly by the fact that one of the principal objectives on which the report is based is to provide data on comparable products or groups of products which are manufactured in the United States and for which rates of duty are specially provided in the Internal Revenue Act of 1916 and in subsequent tariff acts. These classifications are, furthermore, both practical and logical. They were adopted, with modifications which provided more detail as the basis of the organic chemical classification in the latest standard commodity classification. Subclasses in groups, such as vitamins, photographic chemicals, and sulfa drugs are provided whenever possible. This frequently permits a release of a considerable amount of data which would be otherwise confidential.

It has been difficult to decide what is to be included in this report and what is to be omitted. Should production, for example, include a product which is isolated in a plant, run to temporary storage, and later entirely consumed within the plant. Should it include a product which is not isolated but known to be produced and run to storage and later consumed in process. Should it include as production the entire amount of a product manufactured in a plant if only a small fraction was isolated and sold and the remainder consumed without removal from the processing system. Should sales represent only the disposition of material through change in title, or should sales include interplant transfers or inter-subsidiary transfers sometimes made at cost and sometimes at market prices. There was no uniform system of reporting such data until recently. Since 1943, data reported by most companies are on a comparable basis, but certain phases of these problems remain for some types of products.

Another problem concerned with the scope of the report is the addition of new groups such as chemical raw materials derived from petroleum—a group para-

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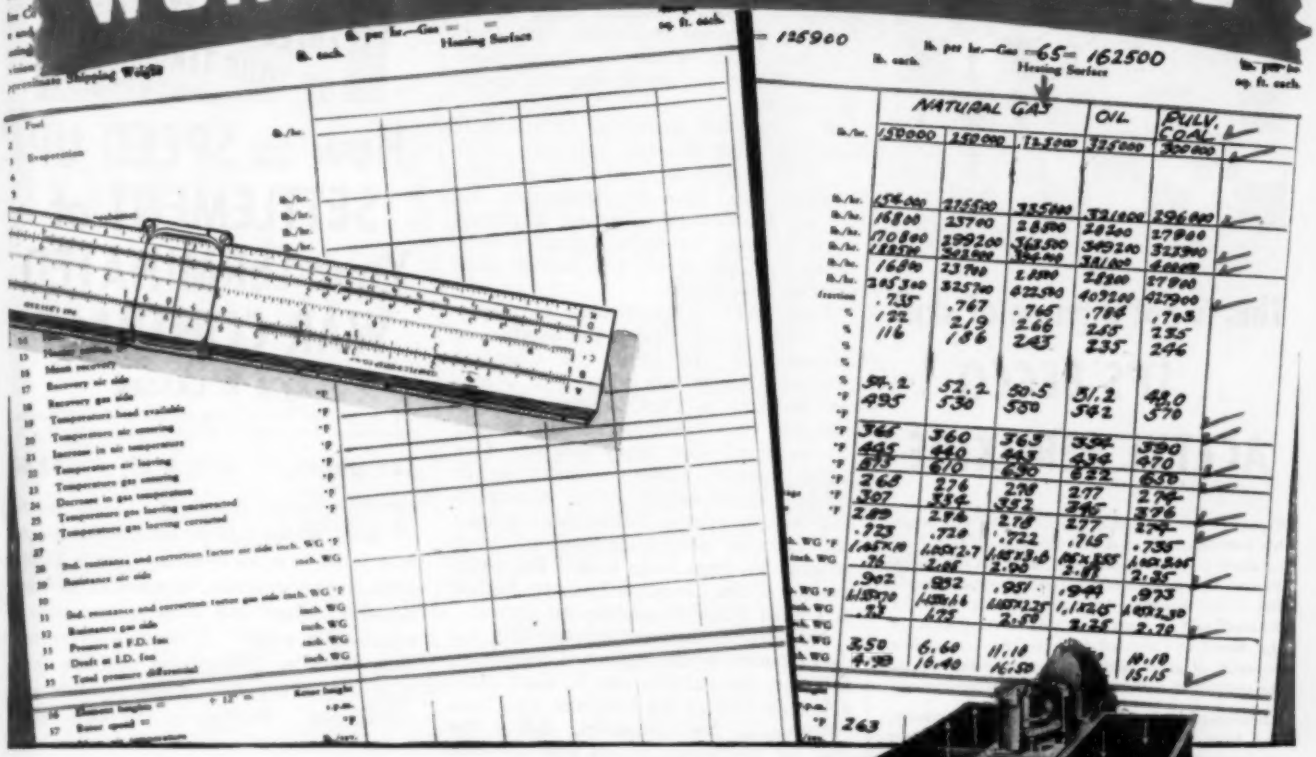

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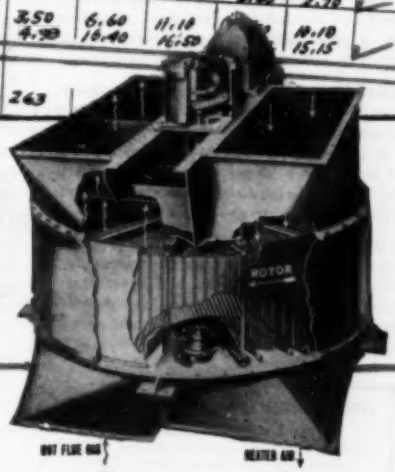

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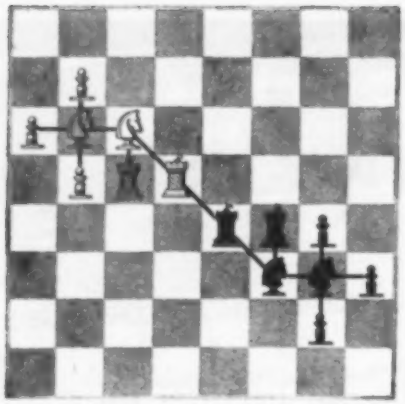

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Perhaps chess was played before Brodie first began his investigations of Acetyl Peroxide in 1863; and certainly prior to a continuation of his studies by Vanino, Clover, Richmond, Gambarjan and Kharash. But its use was more risky than playing chess, for Kharash said of Acetyl Peroxide in the Journal of the American Chemical Society: "An outstanding peroxide of great usefulness but must be used on the spot (of manufacture) because of its sensitivity."

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Besides its value as a polymerization agent, other interesting applications include its use as a germicide, a bleaching and oxidizing agent, and in vulcanization. It has great possibilities in organic syntheses as it is very reactive and offers a source of active oxygen in a non-aqueous medium. *Write for laboratory samples.*

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leling coal-tar crudes. At present the inclusion of this group is something of an experiment; in peacetime the road to follow will probably be more apparent.

Classification of chemicals according to major use presents a serious problem, and, at times, decisions may be somewhat arbitrary. When chemicals come to be used for purposes more important than the one under which they have been classified, they are moved from one group to another.

A more basic change in classification occurred when the two categories, coal tar and non-coal tar, used formerly, were abandoned in favor of classification according to chemical structure, a change made necessary by technological developments, and one which will provide more detailed information.

Many other questions arise in preparing these reports. One is the question of nomenclature. In 1940, the Chemical Abstracts System was adopted as a general standard in these reports whenever complete data could be shown, because it was found that many products were being reported under a multitude of different names which led to incomplete data and inaccurate classification. During the five-year period intervening, much progress has been made toward the extensive use of the Chemical Abstracts System or United States Pharmacopoeia names.

No statistics are more accurate than the data reported by the individual companies. Likewise, the statistics can be made available only after all the schedules have been returned by the companies. Before the war, the preliminary reports were generally available in June of the year subsequent to the period covered; at present they are not available until September or even December. The delay has been caused primarily by late returns. It is hoped that this situation may be remedied under more normal conditions.

Through a better understanding of the problems in using these statistics and a better understanding of problems that arise in the preparation of them, their usefulness to both government and industry can be improved.

J. Hibben, U. S. Tariff Commission, before Chemical Market Research Association, Washington, Sept. 12, 1945.

TECHNICAL SECRETS FROM GERMANY

LARGE areas of German scientific and technological knowledge remain unexplored. If the Nazis are not compelled to disgorge the research treasure still concealed, and if the documentary data already seized by the Allies is permitted to gather dust in the warehouses of Europe, the full fruits of victory will be lost to American industry.

Thus far Allied investigators have touched only the highlights of industrial developments under the Nazi regime. There should be speedy dissolution of I. G. Farbenindustrie, and the disclosure of the real ownership of this "giant octopus." Top flight experts from the United States should make orderly and exhaustive studies of the chemical empire governed by I. G., one of the most potent geopolitical machines in the Nazi plan of

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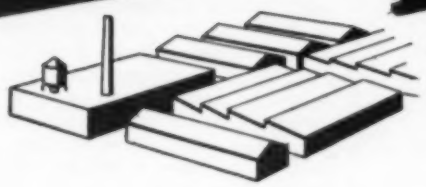

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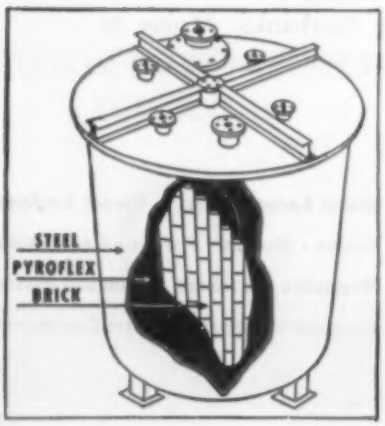

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world conquest, and unfold the whole story of German science and industry.

Documents already ferreted out by Allied technologists should be classified, translated, microfilmed, digested, cataloged, and cross-indexed in detail preliminary to wide distribution to American industries. Unless some such detailed plan is adopted immediately and properly executed, employing the services of adequate numbers of skilled personnel, we stand to lose a large part of the German scientific developments of the past eight or ten years. It would, indeed, be a severe indictment of American intelligence if this veritable gold mine of scientific knowledge is speedily forgotten and is allowed to gather dust in warehouses, or is only partially utilized.

We should continue the present policy of sending highly skilled specialists in large numbers into Germany to supplement reports made by earlier investigators and to study plants, processes and products as yet not covered in intelligence reports. Such men should be recognized top-flight experts in the field or fields assigned to them. Intimate know-how and complete factual data are the objectives.

Ultimate success or failure of any program to enlarge still further our knowledge of the German scientific advances made during the war depends to a large extent on the attitude of Army officials. The Army is in supreme command in Germany and will be for a long time, perhaps even for years. If its policy makers thoroughly understand the scientific treasure in their possession, then likely they will be sympathetic to smartly conceived and boldly executed plans to reveal to science and industry the work of German scientists. If they do not, then we stand to lose one of the most important elements of victory.

Walter J. Murphy, editor, *Industrial and Engineering Chemistry*, before Chemical Market Research Association, Washington, Sept. 12, 1945.

IN SUPPORT OF DR. BUSH

WARTIME mobilization of science and industry has produced a degree of technological advance during the war which is unparalleled in our history. The unified effort of the people toward common ends and the expenditure of federal funds to achieve superb weapons of war has brought home to the people the possibility of having many more of the so-called good things of life, if only we can maintain in peacetime the degree of scientific and technological advance that we achieved in wartime.

The suggestions made by Dr. Bush for a research foundation have been generally commended and also have been attacked by some and will probably be attacked by others as the debate on the merits of various items of enabling legislation proceeds.

Points of attack thus far are not against the integrity or soundness of the scientific or educational recommendations contained in it but rather because it does not advocate that measure of bureaucratic control which is thought desirable by some. It provides for an administrative board of scientists and scientists only and a absolute minimum of regulation. It leave

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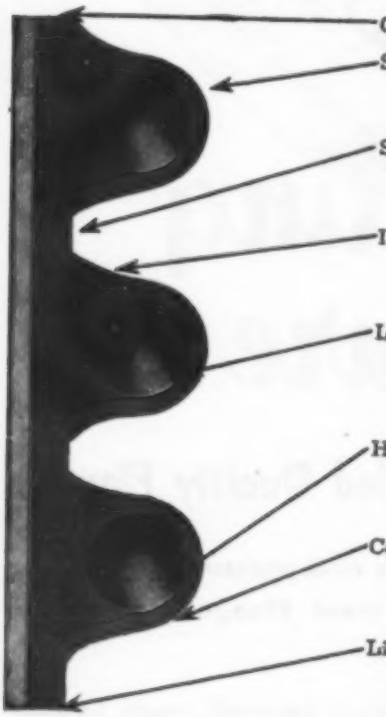

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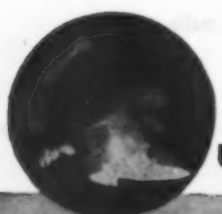

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the patent system where it is—without commending it or condemning it.

There will be little argument about the actual amounts to be spent. The first year's expenditures would cost less than two heavy cruisers of the Alaska type or about as much as one major oil company might earn in a moderate year. The rate of expenditure at the fifth year, $122 million, is about one half of the investment cost by the government in the relatively few government financed plants which we needed for the 100 octane gasoline program—plants which collectively produced only about 10 percent of the gasoline needed by our war planes.

Dismiss as groundless some recently expressed fears that unless all patents based on government-sponsored research are by law assigned to the government, they will slip into the monopolistic control of great corporations whose facilities are used at government expense to develop the inventions. These worries indicate a total lack of appreciation of one basic fact of life—namely, that in peacetime nobody, large or small, who has a going research laboratory would even want to use it for any purposes except his own.

Dr. Bush has given the right answer with respect to the use of federal funds for research, namely, that they should not be used except upon patent conditions appropriate to the circumstances, and that it takes the administrative agency itself to decide those conditions. It would be folly to demand from a university an assignment of all patents merely because of a partial federal subsidy for the training of research men. It would be equal folly for the Ordnance Department to contract with the X company to develop a new machine gun without demanding that the X company assign over all of the resultant patent rights. The greatest folly of all would be to freeze the whole situation by statute so that no discretion could be used by the body administering the funds. To do so might wreck a meritorious program.

Bruce K. Brown, Standard Oil Co. (Ind.), before Kansas City section, American Chemical Society, Sept. 11, 1945.

ECONOMICS OF WESTERN ALUMINUM PRODUCTION

THIS discussion will deal with costs of western aluminum production. It will attempt to picture a realistic balance sheet in dollars and cents and in assets and liabilities. From this we can reach preliminary conclusions on what the chances are for a well-balanced western aluminum industry, and on what needs to be done to favor the chances.

Bauxite, the preferred ore, is transported from mines and drying plants in Arkansas and South America to 6 Bayer alumina plants, five of which are located in the Southeast United States and one in Canada. The total capacity of alumina in the United States is on the order of 2¼ million tons per year. This is equivalent to 2½ billion pounds of aluminum per year, or almost seven times the prewar annual metal capacity. There are no commercial alumina plants west of the Mississippi, although there are three small experimental

Which of these chemicals is your problem child?

CORROSIVE MATERIALS	Recommended HAVEG Grade	Grade Also Satisfactory	Grade Not Satisfactory
Acetic acid	41	43–60	50
Alcohol	41	43–60	50
Aluminum chloride	41	43–50–60	....
Aluminum sulphate	41	43–50–60	....
Ammonium chloride	41	43–50–60	....
Ammonium hydroxide	41	43–50–60	....
Ammonium sulphate	41	43–50–60	....
Aniline hydrochloride	41	43–60	....
Benzol	41	43–60	50
Boric acid	41	43–50–60	....
Calcium chloride	41	43–50–60	....
Carbon tetrachloride	41	43–60	....
Chlorine gas	41	43–60	....
Chlorine water	41	43–60	....
Citric acid	41	43–60	....
Copperas	41	43–50–60	....
Copper sulphate	41	43–50–60	....
Cupric chloride	41	43–50–60	....
Ferric salts	41	43–50–60	....
Ferrous salts	41	43–50–60	....
Fluosilicic acid	43	....	41–50–60
Formic acid	41	43–60	....
Gasoline (sour)	41	43–60	50
Hydrobromic acid	41	43–50–60	....
Hydrochloric acid	41	43–50–60	....
Hydrofluoric acid	43	....	41–50–60
Hydrofluosilicic acid	43	....	41–50–60
Hydrogen sulphide	41	43–50–60	....
Lactic acid	41	43–60	....
Lead acetate	41	43–50–60	....
Muriatic acid	41	43–50–60	....
Oxalic acid	41	43–50–60	....
Phosphoric acid	41	43–50–60	....
Potassium bisulphate	41	43–50–60	....
Potassium chloride	41	43–50–60	....
Potassium hydroxide	50	60	41–43
Potassium sulphate	41	43–50–60	....
Salt brine	41	43–50–60	....
Sodium acid sulphate	41	43–50–60	....
Sodium bicarbonate	41	43–50–60	....
Sodium bisulphate	41	43–50–60	....
Sodium carbonate	41	43–50–60	....
Sodium hydroxide	50	60	41–43
Sodium sulphate	41	43–50–60	....
Sodium sulphate	41	43–50–60	....
Sodium thiosulphate	41	43–50–60	....
Sulphur dioxide	41	43–50–60	....
Sulphuric acid (up to 50%)	41	43–50–60	....
Sulphurous acid	41	43–50–60	....
Tannic acid	41	43–50–60	....
Tartaric acid	41	43–60	....
Tin chloride	41	43–50–60	....
Trisodium phosphate	41	43–50–60	....
Vinegar	41	43–50–60	....
Zinc chloride	41	43–50–60	....
Zinc sulphate	41	43–50–60	....

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Shearing strength, psi	3,500	3,000	2,500
Modulus of elasticity	1,000,000	850,000	.....
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semi-commercial plants on non-bauxitic materials in Wyoming, Utah, and Oregon. Of the United States alumina capacity, almost half is in the ownership of the Aluminum Co. of America, a very small amount is owned by Reynolds Metals, and the rest is in the hands of the DPC but operated by Alcoa. The Canadian alumina operation, equivalent to Alcoa U. S. capacity, is owned and operated by the Aluminum Co. of Canada. Bauxite for this plant at Arvida, Quebec, is supplied by imports from Dutch and British Guiana.

A portion of the total alumina production is normally used by chemical refactories and abrasives industries. Roughly, less than 2 percent of normal production is thus diverted from the principal use—the production of metal. The North American metal-producing plants are definitely more scattered than the alumina plants. With some present exceptions, t plants are in locations of abundant l price electrical power. The total prod tion capacity per year is almost divi in thirds among the Canadian p ducer, the plants of Alcoa, and Reyno and those of the DPC. Geographica the West has slightly over one-third North Continent capacity, the Southe about one-fifth, and the East, Northe and Canada over half. However, much the capacity is not economical in terms peacetime operations, and the ratios thereby be changed somewhat.

With negligible exceptions, the pla in the U. S. for initial fabrication of metal-rolling, extrusion, tubing rod bar, forging, and casting—are located of the Mississippi. The only excepti of note is that of the rolling mill in Pacific Northwest at Spokane, which al represents almost one-fifth of the t

Table I—Range of Representative and Estimated Mill Costs of Producing Aluminum Metal

Cost Item	Prewar Cost, Alcoa Average, 1937	DPC Plants 1943–44 Min.	DPC Plants 1943–44 Max.	Probable Postwar Cost Range—Alcoa Plants Min.	Alcoa Plants Max.	Best DPC Plants[1] Min.	Best DPC Plants[1] Max.	Best West Coast Plant[1] Min.	Best West Coast Plant[1] Max.
Labor	0.79¢	0.996¢	2.602¢	0.980¢	1.276¢	0.996¢	1.243¢	1.089¢	1.2
Alumina[2]	3.23	4.838	5.802	2.582	3.555	2.995	3.824	3.100	3.8
Power[3]	1.22	1.912	6.915	1.350	2.070	1.575	1.890	1.890	1.8
Electrolyte	0.50	0.231	1.299	0.414	0.581	0.231	1.299	0.293	0.4
Carbon	1.00	0.936	1.821	0.959	1.439	0.936	1.821	1.066	1.2
Depreciation	0.12	0.415	0.934	0.000	0.543	0.581	0.934	0.581	1.0
Other items[4]	0.89	0.884	3.135[5]	0.579	0.908	0.884	1.500	0.973	1.3
Range of total[6] mill cost per lb. of aluminum	7.75¢	11.070¢[6]	16.466¢[6]	7.960¢[6]	9.598¢[6]	8.150[6]	9.721¢[6]	8.817¢[6]	9.2

[1] Including only plants with total mill cost under 10¢ per lb. of metal [2] 2 lb. of alum per lb. of metal. [3] 9 kwh. per lb. of metal. [4] Miscellaneous plant expense and plant admin tration, repairs and maintenance. [5] Includes 1¢ per lb. for management fee. [6] Not total column above—individual plant totals.

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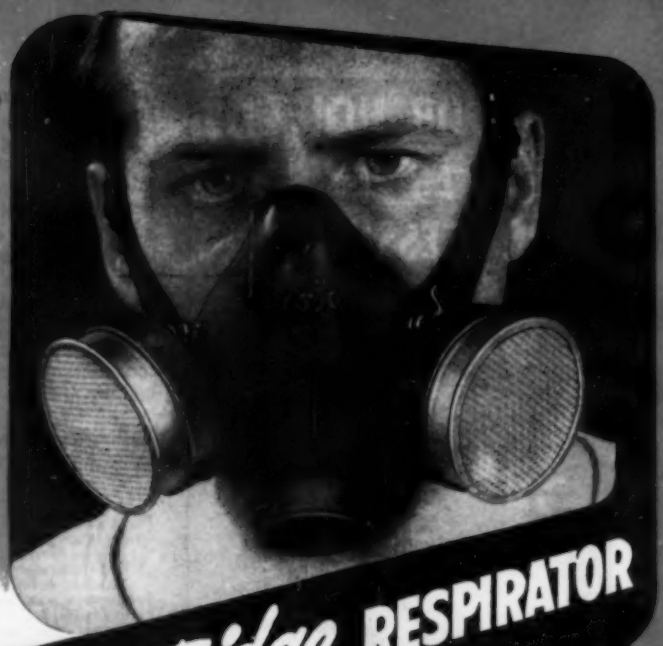

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annual aluminum rolling capacity in the U. S.

Recapitulating the distribution of capacity and location of the elements of the industry, as they appear from a western point of view, the West has the middle layer of a cake without bottom or top layer. That is, the western metal reduction plants have neither present local source of raw material nor generally local outlets for their products.

In this discussion, all costs will be in terms of mill costs, without profits, general overhead, sales expenditures, and gross income taxes. The range of mill costs, in cents per pound of aluminum metal, for U. S. electrolytic reduction plants, is given in Table I. The estimates are reasonable, but possibly subject to change as to exact costs. The comparative levels should be quite correct. The principal items of cost are also shown, such as for labor, aluminum, power, etc. Although it is doubtful that even Alcoa can quite meet the estimates of its 1937 operation, these are shown for the purpose of giving what probably are rock-bottom mill costs. One may conclude, therefore, that

Table II—Hypothetical Postwar Cost Estimates of Producing Alumina at Different Plants Under Various Conditions, Also Approximate Delivered Costs at Pacific Northwest Reduction Plants

Plant and Location	Alcoa, Mobile	DPC, Hurricane Creek	Columbia River
Grade of Bauxite			
Silica, percent	4	7	4
Al_2O_3, percent	57	56	57
Al_2O_3 recoverable, percent	52.6	48.3	52.6
Production cost, per long ton of bauxite (dry basis) [3]	$2.75–$3.20	$3.10–$6.19	$2.75–$3.20
Transportation cost, per long ton of bauxite (dry basis) [3]	4.23	.....	5.23
Total cost of bauxite, per long ton delivered at alumina plant	6.98–7.43	3.10–6.19	7.98–8.43
Equivalent cost of bauxite, per short ton of alumina [4]	11.85–12.61	5.74–11.44	13.57–14.33
Lime and soda ash, per short ton of alumina	4.02	7.04	4.02–5.37
Labor, fuel, power, and other expenses, per short ton of alumina	8.00–12.00	8.20	8.00–12.00
Total cost, per short ton of alumina at plant	23.88–28.64	20.98–26.68	25.59–31.70
Freight to Pacific Northwest reduction plants, per short ton of alumina	8.24	8.24	1.00–3.00
Total cost per short ton of alumina at Pacific Northwest reduction plants	32.12–36.88	29.22–34.92	26.59–34.70
Total cost of aluminum at Pacific Northwest reduction plants, c. per lb	3.22–3.688	2.922–3.492	2.659–3.470

[1] Hurricane Creek plant has used medium grade bauxite (52% alumina, 11% silica) successfully. The Bureau of Mines estimates all reserves of this grade B bauxite at over 34 million long tons mined and dry basis as of 1944. This is equivalent to well over 10 years' full capacity operation. [3] Including mining and drying. [3] Including mine, dryer, import duty, and carrier profit to Bayer plant. [4] Reflecting percentage recoverable alumina.

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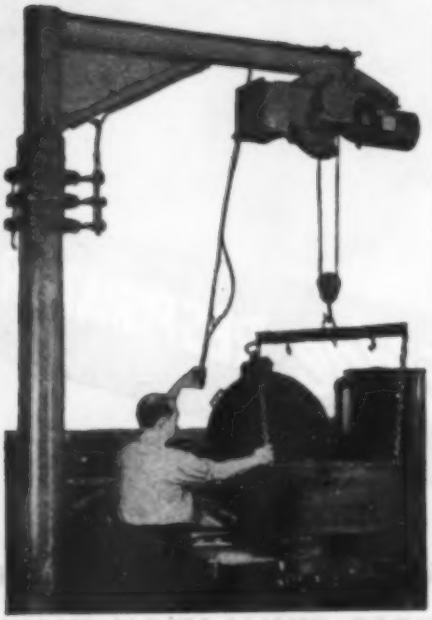

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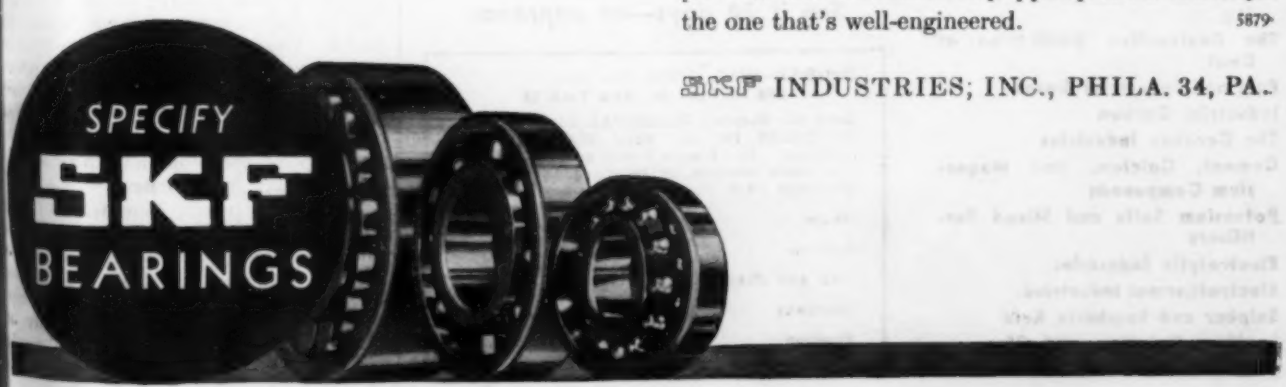

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mill costs have ranged from roughly 7¼ c. per lb. for Alcoa's reported 1937 figures to a high of almost 16¼ c. for a wartime government plant operation. In the latter, we should discount of course extraordinary high war costs on materials, etc. In terms of the Nation's competitive aluminum future, the probable postwar estimated range of costs for Alcoa plants of from 7.96 to 9.6 c. is most significant and controlling. This means that any plant which cannot operate within this range cannot be considered as one with a reasonable competitive chance. This rules out nearly all government plants with the principal exception of the reduction plants at Jones Mill, Ark.; Troutdale, Ore.; and Spokane, Wash.; and possibly at Tacoma, Wash. As to the latter, the margin is one which can be met rather easily. The plant at Los Angeles may also be in a border-line position. It is assumed that all privately-owned plants of Alcoa and Reynolds will also be within this range to continue operation.

Generally, the following indicates the degree of importance of various items to mill cost for the plants under consideration. Alumina accounts for around 40 percent; power for 15 to 23 percent labor between 12 to 14 percent; carbon for around 12 percent electrolyte for between 3 to 6 percent; depreciation and all other plant expenses for the remainder of between 10 to 15 percent. The items most likely to vary considerably in range are alumina and power.

The reasons for variations in alumina and power costs are of primary importance in gaging the competitive future of aluminum plants, particularly in the West. For example, a slight variation in power costs per kwh. is multiplied by almost 10 in the final power cost item because almost 10 kwh. are required per pound of metal. Similarly, anything affecting the cost of alumina will be doubled in effect in the final alumina cost item because two pounds of alumina are required per pound of metal. The fact that 4 lb. of bauxite are needed per pound of metal stresses the importance of that item. Transportation costs in bauxite and alumina count heavily in the final alumina cost item.

Power costs available for aluminum production have varied greatly. In this respect it is important to recall that an aluminum plant requires large quantities of power available every hour of the year. At ordinary rates for industrial power, this might cost 5 to 7 mills per kwh. and between 4 and 7 c. per lb. of metal. Such costs would represent between one-third to one-half of the current cost of producing the metal. Thus, the aluminum industry can only operate in locations where such power can be purchased or can be made available at between 1.0 to 3.3 mills per kwh. This will be the determining factor in both continued plant operation and expansion anywhere in the United States.

Although power considerations are favorable to Pacific Northwest operation, there are some serious questions as to alumina supplies and costs. These are twofold: location and possible ownership. Both will affect costs and continuity of supplies, and both will depend greatly on government policy relative to the dis-

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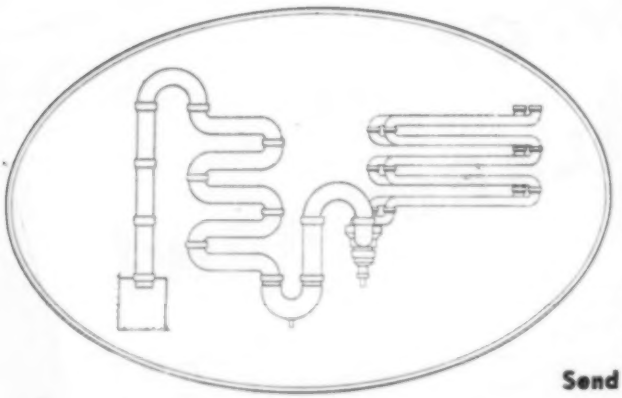

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position of its alumina plants, particularly the one at Hurricane Creek, Ark.

To define the production costs for alumina is a difficult task. The mining of bauxite, its drying, its transportation to ocean ports, its transportation to Bayer alumina plants—all these items carry numerous problems in the allocation of costs and profits. The grade of bauxite, particularly its content of alumina and silica, has direct bearing upon the treatment costs.

Table II shows hypothetical costs of producing alumina at various plants, under various conditions, and arrives at some probable estimates of costs of alumina delivered to Pacific Northwest reduction plants on a postwar basis. Assuming that the data used are relatively sound, an allocation of $30 per ton of alumina at the alumina plant is a very fair one. With a freight rate of $8.24 per ton, the cost of alumina at Pacific Northwest aluminum reduction plants should not be over 3.824 c. per lb. of metal. By the same token, with a local alumina plant, 3.1 c. for alumina per lb. of metal seems reasonable to expect. Given ultimately favorable conditions such as lowest prices for lime, soda ash—which should be cheap in the West—and reasonable prices on a Grade A bauxite, the cost might get as low as 2.7 c. for alumina per lb. of metal.

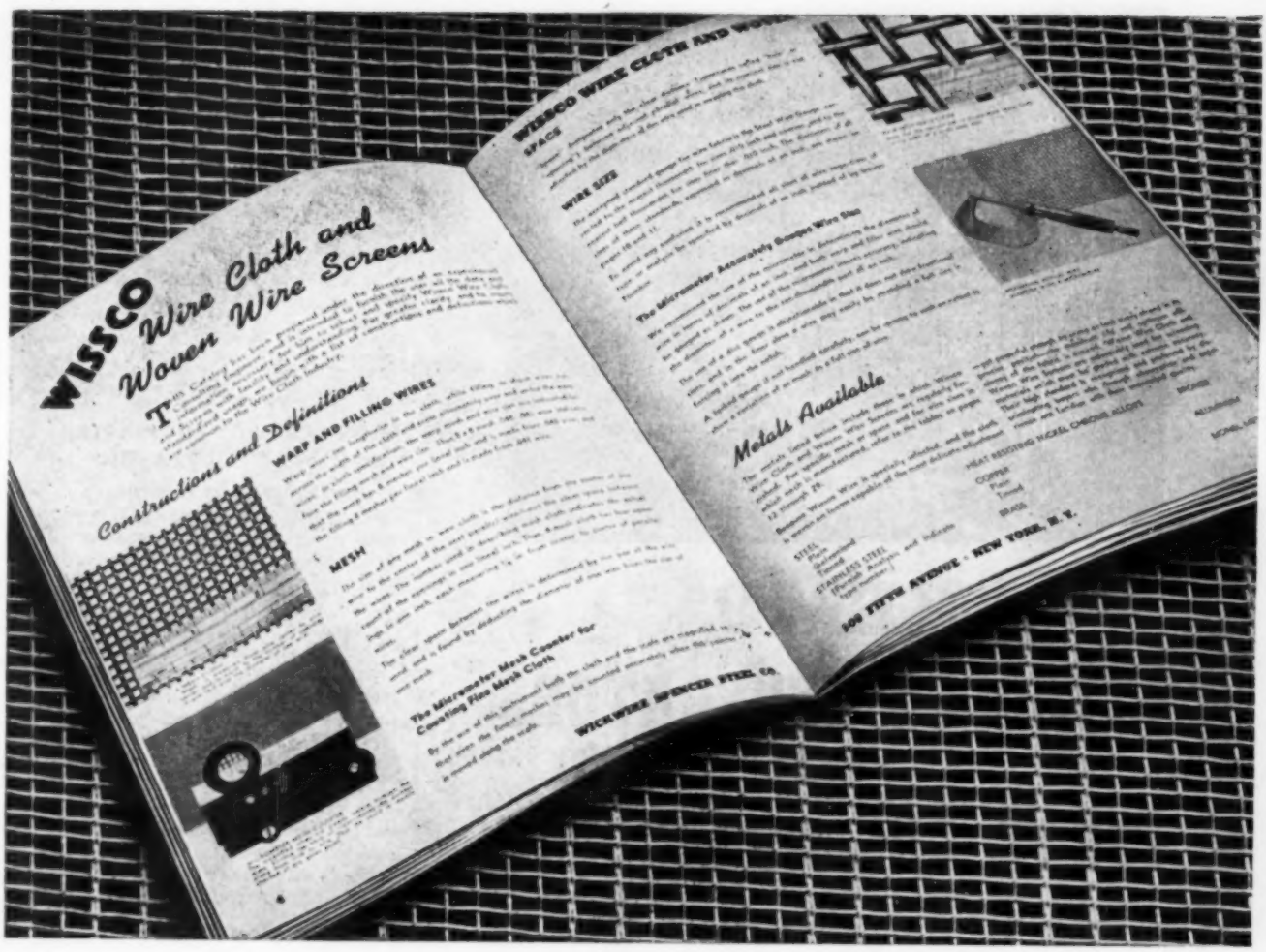
Ivan Bloch, Bonneville Power Administration, before Light Metals Conference, Western States Council, Seattle, Wash., June 21, 1945.

CHEMICAL FUNDAMENTALS OF UNIT PROCESSES

UNIT processes have as their foundation stone the chemical changes upon which are based the processes carried out in the factories. Before any work can be done in the pilot plants or in the factories all phases of the chemical fundamentals must be investigated fully. Such chemical fundamentals involve chemical equilibria or how far reactions will go, the speed of reactions or how fast they proceed, the corrosion caused by the reactions, or the materials of construction for the equipment economically to contain the reactions. Many of these chemical data have been determined but even for old reactions there is still a long way to go before those interested in commercializing reactions can make the calculations necessary for the proper design of the plants.

Chemical engineers as well as physical chemists ought to have the facts upon which they could determine equilibria and rates; these should include the probable varients and the catalysts. Indeed, the absence of these facts for many of our older reactions as well as for the newer ones, handicaps the commercial development of the chemical industry. Even the methods employed should be scrutinized and developed with the idea of their more convenient application to process design.

The corrosion picture changes with new reactions or with new materials for the construction of chemical equipment. For the safest design of plants, corrosion tests should be made on the particular reactions involved using always the technical chemicals which will be employed in the commercialization of the reaction. Here a very



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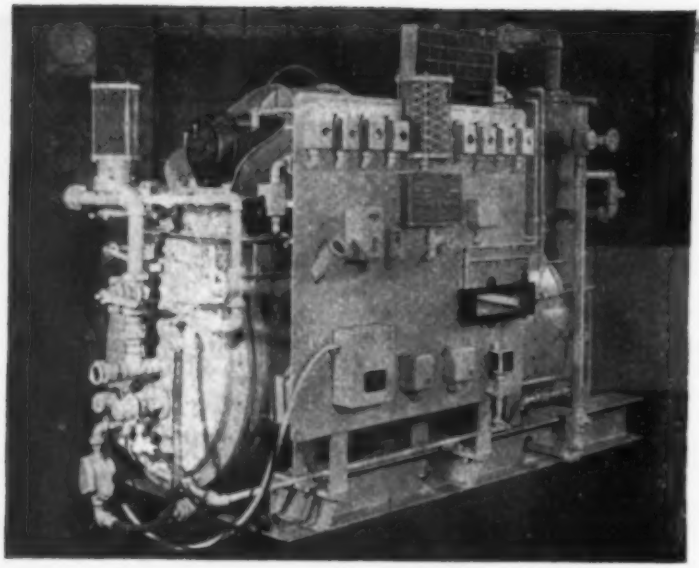

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small amount of impurity in the reacting chemicals or in the constructional material, or even the physical treatment of the material of construction, frequently will have a paramount effect upon the corrosion result.

The culmination of a sequence of unit processes in the factory economically to make the chemical goods for which the procedure was designed, cannot be carried through until all these strictly chemical features are worked out. In other words, the chemical fundamentals must precede the economic manufacture.

R. Norris Shreve, Purdue University, meeting-in-print of Division of Industrial and Engineering Chemistry, American Chemical Society, September 1945.

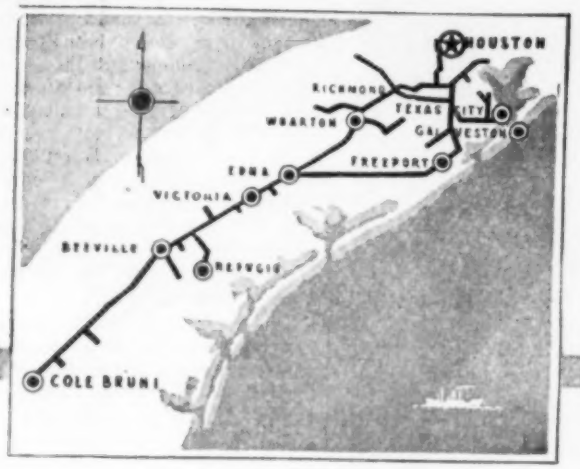
IMPREGNATION OF PLASTER OF PARIS WITH PLASTICS

IMPREGNATION of plaster of paris with plastics materials represents a process which will make appreciable inroads of plastics into the ceramics field. These inroads do not imply the replacement of ceramics with certain plastics, but rather suggest new and judicious combinations of plastics with inorganic materials. The net result means an improved plaster of paris product which has acquired the durability of the plastic, without sacrificing its low price advantage.

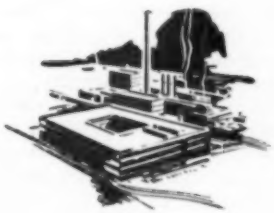
There are two methods of combining plastics with plaster of paris: (1) Before the plaster has been poured, and (2) after the form has been set. In the development of the techniques of indurating plaster with plastics various combinations of organic plastics with plaster before pouring or casting, were investigated. Two techniques were employed: (1) Solutions of the resins were first effected, followed by the addition of plaster; (2) mixtures of the resin in a dry state with the plaster of paris, followed by the addition of water. The latter technique limited the selection of resins to melamines and urea types.

Among other water soluble synthetic resins and cellulose derivatives, combinations were effected with methyl cellulose, polyvinyl alcohol, and sodium carboxymethylcellulose. Most efforts to precombine plastic with plaster of paris were confronted with some loss of the easy technique of handling plaster—either by reason of greater problems of mixing accompanied by lumping and formation of gas pockets in the final castings, or because of delay in setting of the plaster and the development of good early strength which characterizes pure plaster of paris castings. In addition to water miscible resins, it was found possible to include finely divided non-water miscible materials which did not affect setting properties; which, however, detracted from the strength of the final castings. In summary, it may be stated that under certain conditions, attractive and effective combinations of plaster of paris and plastics may be achieved through premixing with plastics though in most cases, they introduce as many disadvantages as advantages gained.

After conducting a considerable amount of work in combination of plasters with plastics before pouring, it was decided to investigate the impregnation of finished plaster castings with various resins. In the last analysis it would mean that plaster



Industry's Redeployment Area— *The* **TEXAS GULF COAST**



As industry expands to meet the accumulated demand for all types of products, location of new plants and relocation of old ones will be an all-important decision for management. One of the vital considerations for any manufacturer is fuel, and the availability of natural gas in unlimited quantities on the Texas Gulf Coast is an influencing factor for many executives facing this problem. Add to this the vast quantity and variety of raw materials available in and adjacent to the Texas Gulf Coast, the year-round mild climate, the pool of native-born labor with new skills learned in the region's war plants, ready-made markets, and unexcelled transportation facilities, and one sees why the Texas Gulf Coast has an irresistible appeal to the forward-looking executive.

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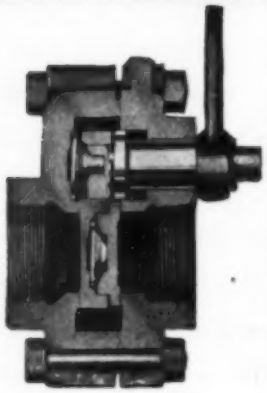

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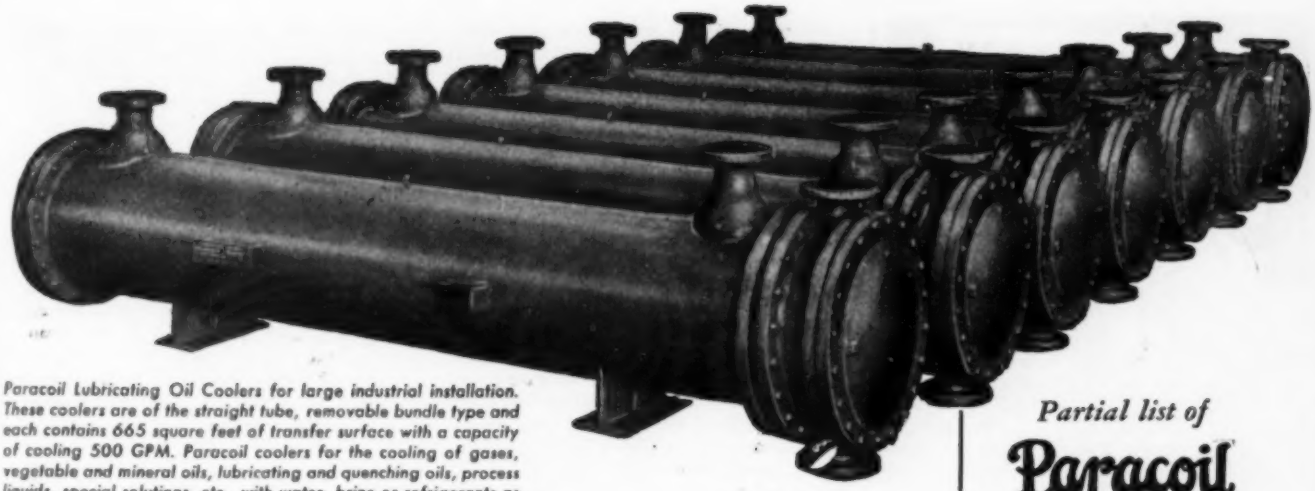
of paris forms, patterns, statuaries, contoured blocks, etc. would be made exactly as they have always been prepared. If upon their completion they are treated with the proper resins and cured, they will gain the advantages of the added plastic and still retain the cost, ease of workability, and dimensional stability of the plaster forms. This proved to be the case and after investigating many types of commercial resins, the procedure was established using a low viscosity furfural resin, developed exclusively for the purpose of impregnating plaster.

Penetration is possible largely because of fine capillaries which are formed in the plaster of paris structure upon the evaporation of the free water. There is a limit to the amount of solids which may be added to water to form the pourable plaster mass. There is always left over a certain amount of free water, which is in addition to the water required for crystallization of the calcium hemi-hydrate. Immediately after pouring of the plaster of paris, the free water separates out and is present in the mass. Two alternatives are apparent: (1) Either use this free water as an avenue of introducing a water soluble plastics material; or (2) remove the water and allow a capillary penetration of the resin. It was found possible to obtain good results with either method, though best properties were obtained by the latter.

If 100 lb. of pure plaster are added to 60 lb. of water a thick, pourable consistency is formed. If less water is used the mixture would be too thick to form a homogeneous dispersion. Approximately 17.5 lb. of the water are required to set the plaster chemically; the balance of 42.5 lb. of water constitutes the free water. When the casting has completely set it will have uniformly dispersed voids in it corresponding to the volume of 42.5 lb. of water—thus determining the maximum amount of resin which may be absorbed for the 100 solids-60 H_2O pour ratio.

Diffusion into substantially dry plaster of paris forms may be accomplished with good results, providing the correct type of resin is employed. The rate of penetration will be found to depend upon many factors, most important of which is resin viscosity and the previous solids-water ratio at the time of pouring. The optimum proportions of solids-water ratios recommended are as follows: Plain casting plaster, 100 parts solids to 60 parts water; "Hydrocal"—low expansion plaster—100 to 45; "Hydrostone"—high strength plaster—100 to 32.

Diffusion of a furane resin of 2 to 3 centipoises viscosity into dry plaster of paris castings is rapid. Straight plaster is best treated with Resin XP, an acid catalyzed resin; while "Hydrocal," which is buffered on the alkaline side, is best impregnated with Resin XR, an alkaline catalyzed furane resin. Overnight, several inches penetration have been obtained into dry plaster of paris forms, and while greater rates and amounts of penetration can be realized with the aid of vacuum, the entire technique may be accomplished at atmospheric pressure and at room temperature. Depth of penetration may be readily controlled if only a surface penetration effect



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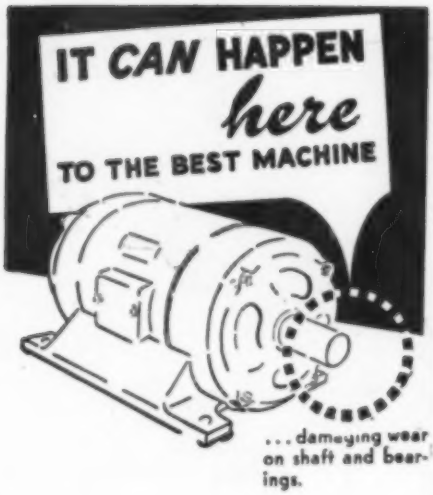

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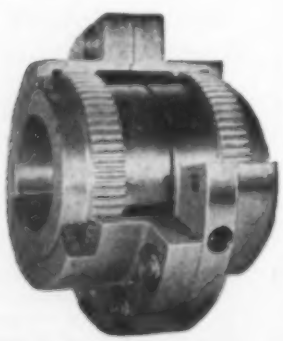

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is required—though for optimum results, full penetration of the plaster of paris forms is recommended. The penetration rate is remarkably fast, and results are quite reproducible.

Furane resins possess excellent wetting properties, and will penetrate into plaster much as water penetrates into a porous blotting paper. Application is very simple, either by immersion or brushing on the final shape. Among other resins suited for penetration into dry plaster forms or patterns are aqueous phenol-formaldehyde, urea-formaldehyde, or melamine-formaldehyde resin solutions. Phenolics penetrate the best and the melamine solutions the least satisfactorily. The melamines have the advantage of the lightest color, forming a clear surface film which, however, checks appreciably after several weeks. Water soluble phenolic resins can be employed with good results, and after the water has been removed may be effectively cured to develop good strength properties. The combination, however, lacks the superior strength of the furane resin impregnated types and the ability to take higher operating temperatures for appreciable periods of time. From careful examination the answer appears to lie once again in the amount of resin successfully introduced into the voids left by the free water at the time of pouring.

The furane resins are liquid resins containing no solvents, and what enters the plaster remains there and is converted to useful properties. While the resins may be cured ultimately at room temperature, heat curing is recommended. When full impregnation is practiced, the resin impregnated plaster should be heated slowly not only to avoid stresses but also to prevent sweating out of the resin on the outside surface. Initial temperatures of 125-140 deg. F. are recommended followed by a few hours at 180-190 deg. F. Large forms are cooled slowly according to conventional practice for large castings.

When it is desired to develop maximum impact strength, cotton or glass wool added to the plaster of paris before pouring and then subsequently cured with fur-

Comparison of Resin Impregnated Plaster and Unimpregnated Plaster

	Physical Properties	
	Casting Plaster of Paris — Dry	Furane Resin Impregnated Plaster
Specific gravity (dry)	1.14	1.65
Specific gravity (wet)	1.60	....
Ultimate compressive strength, psi	1,800–2,000	8,000–9,000
Flexural strength, psi	500–700	2,500–3,500
Impact strength-Charpy ft. per in	0.2 to 0.4	1.2 to 1.4
Surface hardness-Barco indenter	too low	30
Shrinkage	negligible	negligible
Water Absorption — ASTM — 24 hr., percent	26	under 2
Max. continuous temperature (no loss in strength), deg. F	120	180
Effect of acids, alkalis	Pronounced	Very small
Thermal expansion coefficient	.....	0.000022

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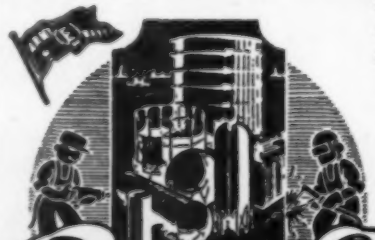

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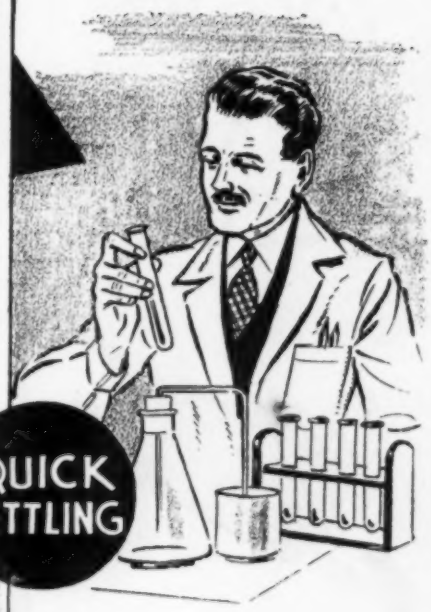

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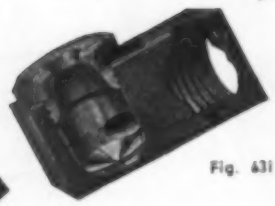

Fig. 631

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ane resin, will give a structure capable of taking much mechanical abuse.

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The application of furane resins to dry plaster of paris forms does not result in any build-up on the surface of resin. Some pieces look like polished ebony. Stretch press dies find this high surface polish a decided advantage. Unlike straight plaster of paris, furane resin impregnated plaster is capable of taking many light surface and decorative finishes without danger of peeling off.

John Delmonte, technical director, Plastics Institute, Los Angeles, before the Society of the Plastics Industry, Los Angeles, Aug. 28, 1945.

FOREIGN LITERATURE ABSTRACTS

AMMONIA FROM CYANAMIDE

AMMONIA production in Chile is small compared to the consumption. In 1941, for example, the national production was 256,747 liters of aqueous solution and 25,943 l. of anhydrous ammonia, whereas imports ran up to 22,078 kg. of aqueous solution and 106,324 kg. of anhydrous ammonia, in addition to various ammonium salts, especially nitrates, chloride and carbonates. The most feasible method for Chile to manufacture her own ammonia would be from calcium cyanamide. (A flowsheet accompanying the original article shows the operations for production of the cyanamide from calcium carbide and nitrogen.) The nitrogen could be obtained from numerous plants in Chile which produce liquid oxygen and have no use for their residual nitrogen. Calcium carbide is readily available in the country, and although its cost is still somewhat high, the cost of the cyanamide would be sufficiently low to assure a very satisfactory selling price for the ammonia. Cyanides and urea could also be produced from the cyanamide and the latter used to expand the domestic plastics industry.

Digest from "Calcium Cyanamide, Possible Source of Ammonia in Chile" by Mauricio Jacobs B., *Revista de Ingeniería Química*, Universidad de Concepción, III, No. 3, 27-35, 1944. (Published in Chile.)

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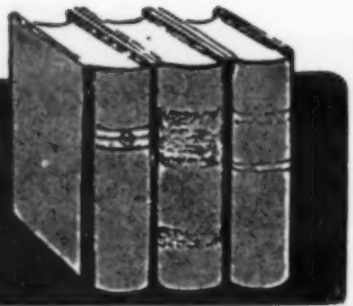

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and EDWIN R. THEIS,
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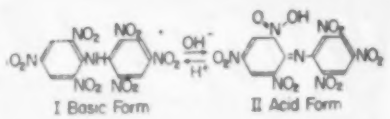
an acid group and a former of salts. The transformation from the yellow basic form I, which is insoluble in water, to the reddish orange acid form II, which is soluble in water and from which the salts are derived, proceeds by the action of the OH^- ions and can be stopped by the H^+ ions. The following equilibrium therefore exists between the two tautomeric forms:



I Basic Form II Acid Form

The reddish orange colored sodium salt has the constitutional formula of the acid form which is true of all the other K, Cs, Rb and Tl salts of dipicrylamine which form as reddish orange precipitates by the action of sodium dipicrylamine. It is probable that dipicrylamine salts which are difficultly soluble in water, such as those of potassium, thallium, etc., can be looked upon as inner complexes of the corresponding metals. This theory is confirmed by the possible formation of a pentagonal ring by union, through the secondary valences, of the metallic atom to the nitrogen atom located in the center. This pentagonal ring is characteristic for stable inner complexes. The intense coloration and the insolubility of the salts in dilute acids also indicates the formation of inner complexes. Solubility of these salts in fused dipicrylamine could not be determined since they decompose at such a high temperature (238 deg. C.), but dipicrylamine and its potassium and thallium salts are very soluble in the following organic, liquid or fused nitro-compounds: nitromethane, nitrobenzene, alpha-nitronaphthalene, dinitrobenzene, and o- and p-nitronaphthol. Dipicrylamine and its salts dissolve in large quantities in nitromethane, which has the simplest structure, whereas they do not dissolve in fused diphenylamine. This is striking proof that the solubility can be deduced from the presence of equal atomic groups in the solvent molecule.

Digest from "Solubility and Reactivity of Inner Complexes in Fusions of the Complex-Forming Compounds" by Fritz Feigl, Luiz Ignacio Miranda and Hugo A. Spinelli, *Chemical Investigations* No. 11, 79-95, 1943. (Published in Brazil.)

EFFECT OF FILTRATION ON QUALITY OF FILTRATE

FILTRATION cannot be considered as a simple screening process which separates the solid particles from the liquid molecules, as the process involves many other factors such as adsorption and electrostatic phenomena. The difficulties of filtering fatty substances vary with the procedure and the state of preservation, even with the same type of product. Graphically, the relationship of the volume of filtered liquid to the time of filtration is a straight line for crystalline substances. In the case of gelatinous materials this line curves toward the time axis. The proper selection of the filtering material, the addition of special products or their previous treatment will determine a greater or lesser curvature for the volume-time function. Suction is also used but the results are not

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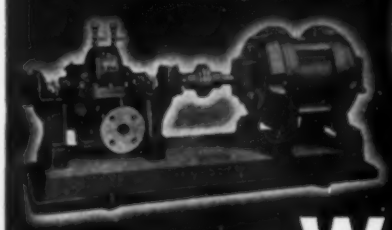

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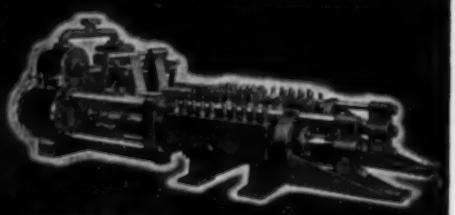

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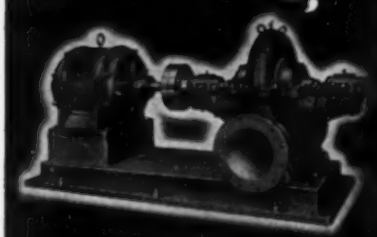

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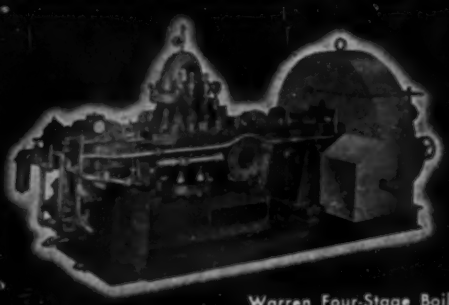

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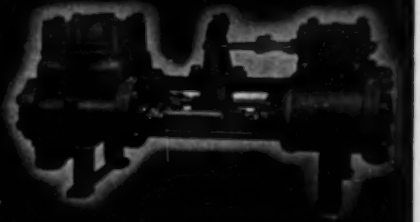


as good as those obtained with compression. Filtration with presses and bags is recommended for fatty substances. In some cases asbestos is considered a good filter medium because of its structure and absorbent properties.

Digest from "Mechanical Filtration and Its Influence on the Quality of the Filtered Products" by A. Meyer, *Fett. u. Seifen* 49, 525, 1942. (Published in Germany.)

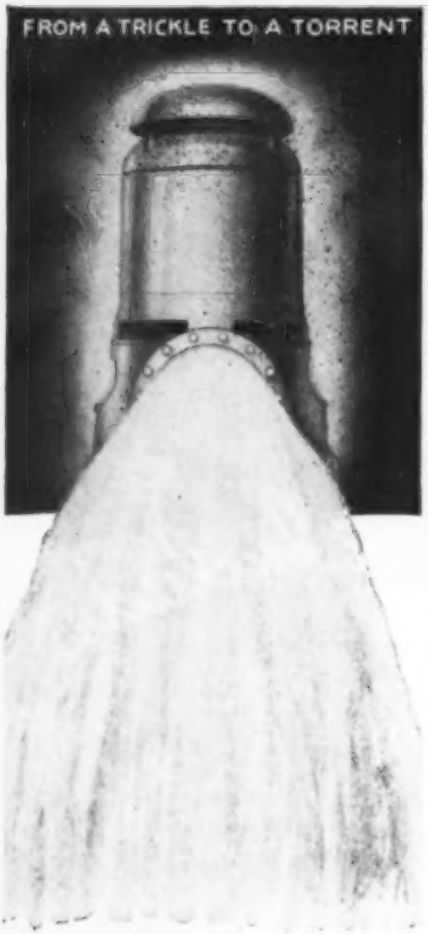
FOUNDRY SANDS

SELECTION of foundry sands is made on the basis of the following properties: grain size, permeability, content of agglutinant or clay, sintering point, degree of fineness, grain distribution, percentage of fines, resistance to compression, outline and scraping, durability, inclusions and form of grains. Three types of sand were chosen for study as shown in the attached table. Type *A* was found to be inapplicable for industrial use since it is not readily moldable, but it can be used in a mixture with other types of sand. Type *B* was found best for casting non-ferrous metals, but it has the disadvantage of having a low sintering point and of causing crusts and inclusions of mud in the cast pieces. These defects limit its use to the casting of brasses with a minimum of 33 percent zinc. It could be used in casting aluminum if a certain tolerance is permitted in regard to permeability. The high content of limestone also makes it less acceptable. Type *C* has too much clay to permit its use in casting bronzes and brasses. It can be applied in casting aluminum since it can tolerate the high compression load which corresponds to optimum humidity for non-ferrous metals. The low sintering point of types *B* and *C* makes it inadvisable to mix them with other types of sand.

Digest from "Foundry Sands" by Roberto Borges Trajano, Report No. 6, National Department of Mineral Production, 1943. (Published in Brazil.)

Characteristics of Three Types of Foundry Sands

Property	Type A	Type B	Type C
Grain form	Subangular	Subangular	Subangular
Humidity	None	1.6%	1.7%
Content of agglutinant or clay	0.5%	12.6% and 13.4% (screened through 20 mesh)	18.0%
Degree of fineness	78 mesh	138 and 147 mesh	155 mesh
Distribution of grains			
Maximum concentration in percent	98.7	77.4	71.6
Screens	70	140	140
	100	200	200
	140	270	270
Percentage of fines	0.7%	67.5%	69.9%
Sintering point, approx	1,300 deg. C.	1,200 deg. C	1,200 deg. C.
Inclusions	Small quantity of ilmenite, sodium chloride, and very small amounts of clay and magnesium carbonate	Clay, limestone, hydrated biotite, mica, and a very small quantity of ilmenite	Same as B but less limestone



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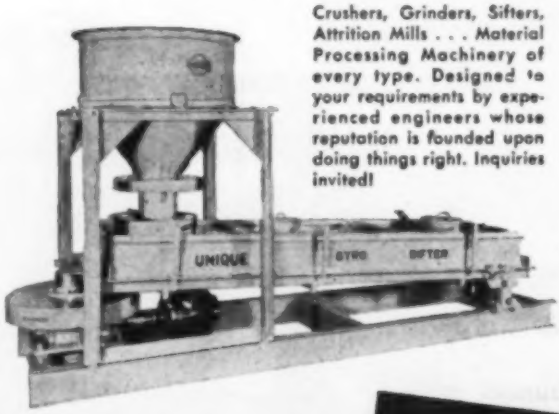

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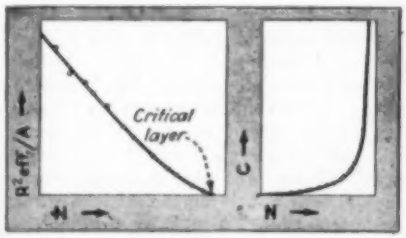

Solution to one problem in the atomic bomb development. Right—How neutron activity increases with number of completed layers (N) in a spherical chain-reacting pile; C = counts per min. Chart (left) indicates at what layer critical size is reached; R = effective radius. A = activity

HISTORY-MAKING

ATOMIC ENERGY FOR MILITARY PURPOSES. *By Henry D. Smyth. Published by Princeton University Press, Princeton, N. J. 264 pages. Price $1.25 (paper), $2 (cloth).*

Reviewed by S. D. Kirkpatrick

PROFESSOR SMYTH'S report of the atomic bomb project has some of the same history-making significance that goes with its subject. When the War Department requested its preparation last summer, there was a break with all the precedents that had protected this most secret of all military projects. Once the decision was made to reveal the underlying science and research, the author made history in piecing together, in a matter of a few weeks, the most comprehensive statement of a most complicated development. Originally issued by the War Department in August in lithoprinted pages, the supply was soon exhausted. Those who were fortunate enough to receive press copies almost wore them out in sharing them with others. Then the Princeton Press stepped in and in less than a month, the entire report was published with additional illustrations and official material as well as a most useful index. At the same time arrangements were made for its low-cost distribution as a public service of this nonprofit publishing organization. (An abstract of the engineering phases discussed in the Smyth report appears in the September issue of *Chem. & Met.* pp. 102-8.)

Perhaps we should point out for those readers who have not seen the original report, that it was addressed not to the layman, but to the scientist and engineer who could claim no expertness in nuclear physics. For all who are willing to invest a few hours in its study, this book is indeed a most satisfying as well as history-making document. We should be more than grateful to General Groves and the War Department for releasing so much scientific information, yet some of us who are concerned with industry's contributions to the atomic power project can not help but feel the need for a companion volume that will outline in a little greater detail the role played by engineers and equipment manufacturers. Their bold planning of the program of production and the miraculous construction and operation of the huge facilities in Tennessee, Washington and New Mexico are the basis for one of the most dramatic chapters in the history of America's war efforts. When security permits, we hope that the War Department will be equally generous and broadminded in releasing the type of information that will promote "Atomic Energy for Peacetime Purposes."

THE TOP TEN

INDUSTRIAL PLASTICS. *Third Edition. By Herbert R. Simonds. Published by Pitman Publishing Corp., New York. 390 pages. Price $5.*

MANY new developments among materials together with the introduction of high-frequency heating since the second edition of this book was completed have made the new edition advisable. The original arrangement of the material was retained as far as possible. Ten of the most important plastics again have been selected for special consideration; several new ones replace others that have lost some of their importance.

VERY REAL HELP

INDUSTRIAL OIL AND FAT PRODUCTS. *By Alton E. Bailey. Published by Interscience Publishers, New York. 735 pages. Price $10.*

Reviewed by Donald F. Othmer

HERE is a monumental compilation of the technology of fats and oils. The first two sections (184 pp.) are devoted to the chemical and physical nature of the fats and oils of commercial importance, together with a discussion of their composition, characteristics, and availability. The third section (240 pp.) is devoted to industrial utilization of fats and oils. Each chapter of this section has to do with the fatty materials used in a different industry; and there is a description of the methods used in each industry. The style of presentation of this is particularly well chosen; and much related background of history and cognate aspects is presented (e. g., five pages devoted to the legislation regarding the use of margarine).

The final 212 pages are devoted to the unit processes in oil and fat technology, and these are covered in detail. Of particular advantage to the technologist is this section, wherein all of the tools or processes for working fats and oils are classified and described.

The printing and paper are of excellent quality; and 111 photographs and drawings of equipment, flowsheets of processing, and charts of data greatly aid the presentation.

The bibliography and index have been carefully prepared and increase the utility as a reference treatise. Throughout the book much new material not hitherto published is presented, particularly in some of the unit processes. The writing is critical and analytical of processes and uses; and the evaluations are helpful in understanding the best of modern practice. This carefully prepared and edited book brings up to date the subject and will be of very real help to everyone engaged in any way in the manufacture or use of fatty materials.

LEATHER CHEMISTRY

THE CHEMISTRY OF LEATHER MANUFACTURE. *By G. D. McLaughlin and E. R. Theis. Published by Reinhold Publishing Corp., New York. 196 pages. Price $4.*

Reviewed by Kenneth E. Bell

MCLAUGHLIN and Theis have completely rewritten the second edition of the work of the same title by the late John Arthur Wilson, condensing it from 1,140 pages to 790. They have accomplished this by restricting the subject matter to fields with which they are thoroughly familiar and in consonance with the editorial board's policy that monographs should cover a relatively restricted field to be true to character.

The authors and their collaborators—Warren E. Emley, John H. Highberger, Ralph E. Porter and Karl F. Ruppenthal—cover the fields of skin histology; chemical

RECENT BOOKS RECEIVED

Advancing Fronts in Chemistry. Vol. 1—High Polymers. Ed. by S. B. Twiss. Reinhold. $4.

Atomic Energy for Military Purposes. By H. D. Smyth. Princeton. $1.25.

The Chemical Constituents of Petroleum. By A. N. Sachanen. Reinhold. $8.50.

Collected Papers on Metallurgical Analysis by the Spectroscope. Ed. by D. M. Smith. British Non-Ferrous Metals Research Association. 21s.

Handbook of Industrial Radiology. Ed. by J. A. Crowther. Edward Arnold.

Introduction to Magnesium and Its Alloys. By J. Alico. Ziff-Davis. $5.

Major Instruments of Science and Their Applications to Chemistry. Ed. by R. E. Burk & O. Grummitt. Interscience. $3.50.

Paint, Paintings and Restoration. 2nd ed. By M. Toch. Van Nostrand. $5.

Physical Methods of Organic Chemistry, Vol. I. Ed. by A. Weissberger. Interscience. $8.50.

Principles of Process Control. By D. P. Eckman. Wiley. $3.50.

The Technology of Plastics and Resins. By J. P. Mason & J. F. Manning. Van Nostrand. $6.50.

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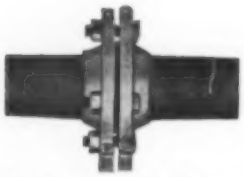

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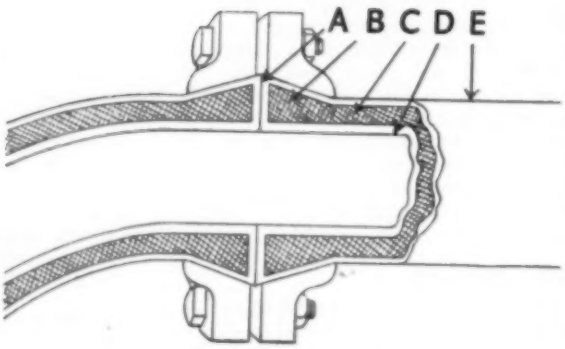

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characteristics of skin and proteins; curing, soaking, liming, bating, pickling, tanning by all well known agents, and fat liquoring and stuffing. Mechanical operations on leather and dyeing, drying and finishing are omitted from consideration and for these subjects the authors refer the reader to Wilson's "Modern Practice in Leather Manufacture," and his second edition of "The Chemistry of Leather Manufacture."

Recent literature on the subjects is covered and supporting data is presented in detail and thoroughly discussed. While the book can be criticized for failing to bring out clean-cut conclusions, in fairness (and as the authors point out) this enormous and complex field is still so far from completely explored that it is difficult to reach definite conclusions which will stand the test of time. Also, since the authors have been such indefatigable workers in leather research, they are called on in many instances to evaluate critically their own work.

This book will prove of value to workers in the leather field and chemical engineers who desire a thorough treatment of the subjects listed above. They will find adequate discussions of the present state of knowledge of the collagen molecule in light of the x-ray and electron microscope techniques; and the resulting concepts of chains, side chains and cross linkages. The authors use charts and tables extensively but have resisted the temptation to secure brilliance by excessive use of illustrations or by speculating on fields beyond their definite experience. Confidence is inspired in the reader's mind that questionable data, which marred earlier works on the subject, have been eliminated.

AIR TABLES

THERMODYNAMIC PROPERTIES OF AIR. *By Joseph H. Keenan and Joseph Kaye. Published by John Wiley & Sons, New York. 73 pages. Price $2.25.*

GROWING interest in the gas turbine has emphasized the need for a working table of the thermodynamic properties of air. To fill this need Keenan and Kaye have published their book, the main table of which gives enthalpy, relative pressure, internal energy, relative volume and ϕ for air at low pressures from 300 to 6,500 deg. Abs. Other tables give specific heats, polytropic functions, and other functions and conversion data. Several pages of examples illustrating use of the tables are also included.

RECENT THEORY

ADVANCES IN NUCLEAR CHEMISTRY AND THEORETICAL ORGANIC CHEMISTRY. *Edited by R. E. Burk and Oliver Grummitt. Published by Interscience Publishers, New York. 165 pages. Price $3.50.*

Reviewed by F. C. Nachod

HERE is the third volume in the "Frontiers in Chemistry" lectures at Western Reserve University, which again touches a very great field of interest. There are five experts who contributed to the book. A. S. Keston discusses isotopes and their applications to biochemistry. Applications of isotopes to heterogeneous catalysis

When the Atomic Bomb hit Taylor's...

THE Atomic Bomb landed on American industry long before it devastated Hiroshima and Nagasaki. Maybe it hit you harder than it hit us. All we know is that here at Taylor Instrument, it had an impact not only on our own organization, but on our suppliers and our customers. Here is what happened:

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is treated by Hugh S. Taylor. H. R. Crane teaches the techniques in nuclear physics. The following paper is by Leslie G. S. Brooker on resonance and organic chemistry, and the final contribution deals with the hydrogen bond and comes from W. H. Rodebush.

All these sections are of the nature of surveys and no effort is made to cover the subject comprehensively. This is quite understandable since these are primarily lectures, dealing with the fundamentals and not comprehensive studies such as the contributions to "Chemical Reviews." Thus the primary object, to introduce readers less familiar with these specific fields, has been accomplished in a quite satisfactory manner.

This volume is, however, not as homogeneous in the selection of contributions as its forerunners; e.g., Vol. II, "The Chemical Background for Engine Research" (see review *Chem. & Met.* Sept. 1943, p. 204) but this fact does not detract from the value of the book which makes for good and interesting reading.

INDUSTRY SURVEY

OILS AND FATS. *By H. G. Kirschenbauer. Published by Reinhold Publishing Corp., New York. 154 pages. Price $2.75.*

Reviewed by Donald F. Othmer

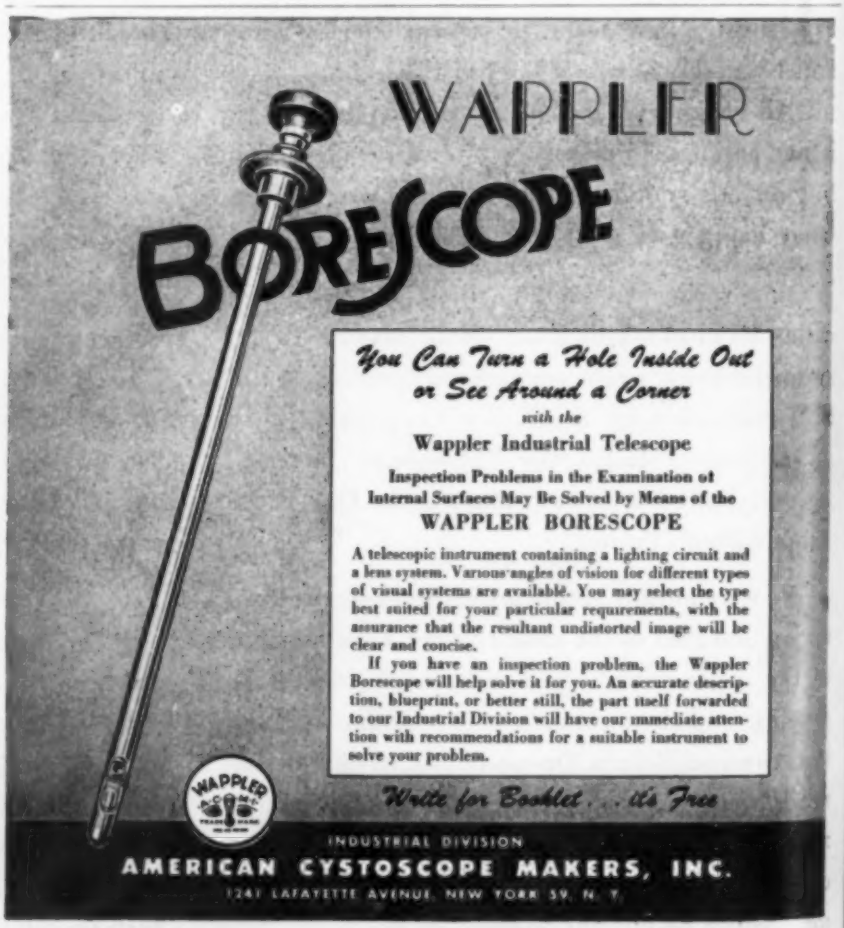
THIS is a readable outline of many of the important facts relating to fats and oils. It is an elementary presentation and makes no attempt at completeness. It is well adapted to one wishing general information or a survey of the industry as a whole, rather than to one needing complete or critical detail about any particular process or material. The broad strokes used to touch parts of such an immense field have not been analytical; and some antiquated methods are sometimes given undue space. The 16 photographs and line drawings are valuable and selected for the reader interested in a brief, over-all, and simplified description of this subject.

FURNACES AND APPLIANCES

INDUSTRIAL ELECTRIC FURNACES. VOL. I. *By V. Paschkis. Published by Interscience Publishers, New York, 232 pages. Price $4.90.*

IF IT weren't so unfair to the author, his treatise might be labeled "Summary." All the various types of electric furnaces are there—or will be after Vol. II is published—with all the facts regarding their construction and operation. Vol. I covers arc furnaces, electrode melting furnaces, and the specially designed ferro-alloy furnaces; the second volume will take up resistance, capacitance and induction heating. Also in the first volume is a general chapter which presents the economics of electric heating together with the thermal and electrical theory on which furnace calculations are based.

To call the book a summary would be to overlook an important motif which the author carries throughout the whole work. This may be illustrated by a quotation: "Much of the design of arc furnaces is empirical; at least no systematic investigations . . . have been published to justify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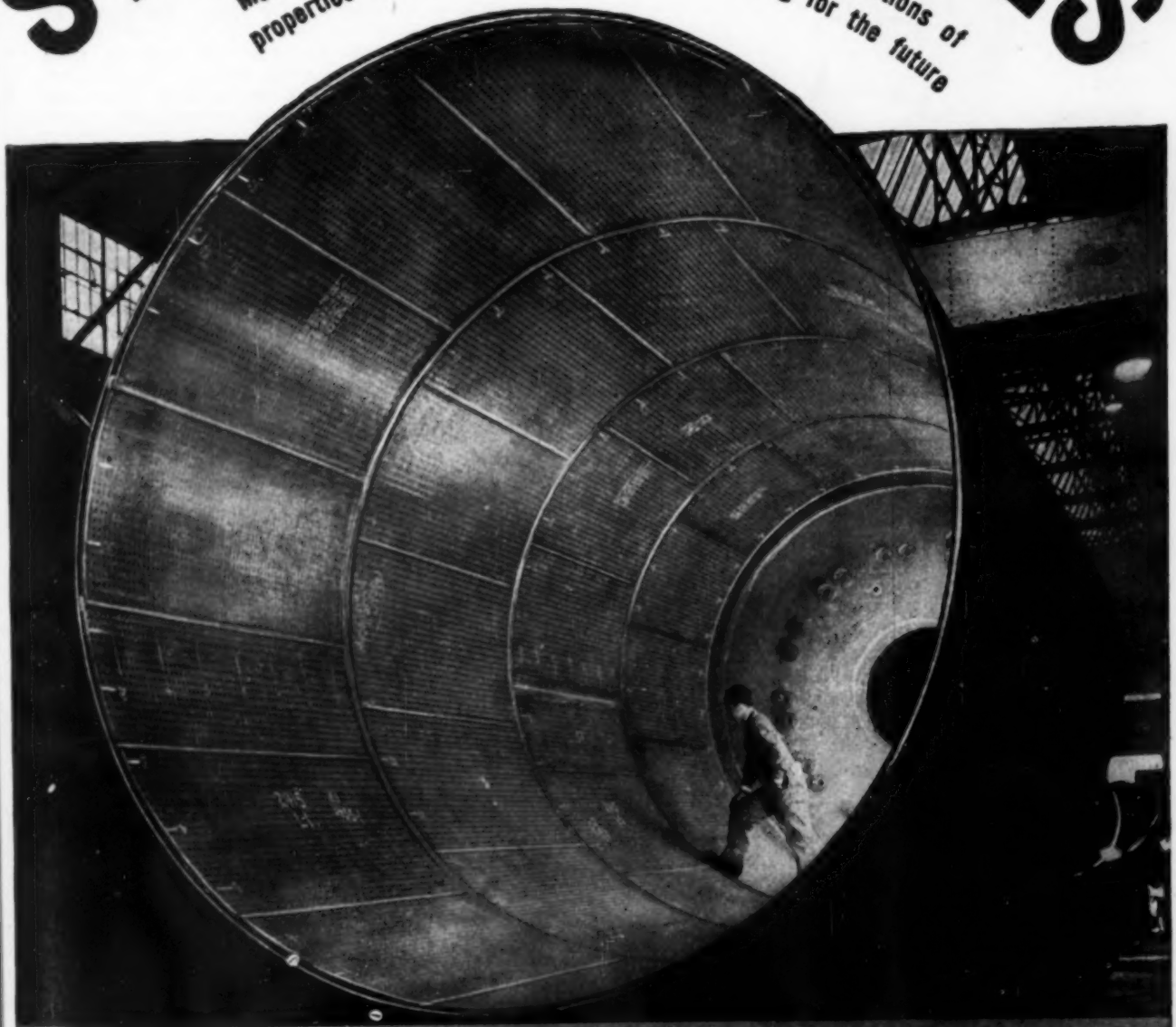

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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering publications noted in this list always give the complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from the bureau responsible for its issue.

Future of Light Metals with Particular Reference to Interests of Small Business. Interim Report of the Surplus War Property Subcommittee. Senate Subcommittee Print No. 5. Senate Small Business Committee.

Animal and Vegetable Fats and Oils, Calendar Years 1940-44. Bureau of the Census. Price 10 cents.

Chemical Hazards. Two pamphlets issued by Labor Standards Division. Controlling Chemical Hazards Series 1 deals with ammonia, price 5 cents; Controlling Chemical Hazards Series 2 deals with chlorine, price 10 cents.

Water Levels and Artesian Pressure in Observation Wells in the United States in 1943. Part 3. Southeastern States. By O. E. Meinzer, L. K. Wenzel and others. Geological Survey Water-Supply Paper 987. Price 35 cents.

Manganese and Iron Deposits of Morro Do Urucum Mato Grosso, Brazil. By John Van N. Dorr, 2d. Geological Survey, Bulletin 946-A. Price 75 cents.

Hydrogen Sulfide Poisoning as a Hazard in the Production of Oil. By Sara J. Davenport. Bureau of Mines, Information Circular I.C. 7329. Mimeographed.

Fluorescence Test for Uranium. By Claude W. Sill and H. E. Peterson. Bureau of Mines, Information Circular I. C. 7337. Mimeographed.

An Employee Suggestion System for the Small Plant or Store. By Donald Wilhelm, Jr. Bureau of Foreign and Domestic Commerce. Economic (Small Business) Series No. 45. Mimeographed.

United States Foreign Trade Statistical Publications. Bureau of the Census. One pamphlet lists reports covering calendar years 1941-1944; the other lists monthly reports starting with statistics for January 1945. Mimeographed.

Radar, A Report on Science at War. Office of War Information. Price 15 cents.

A General Account of the Development of Methods of Using Atomic Energy for Military Purposes. War Department. Price 35 cents.

Marketing and Manufacturing Margins for Textiles. By L. D. Howell. Department of

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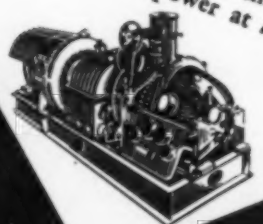

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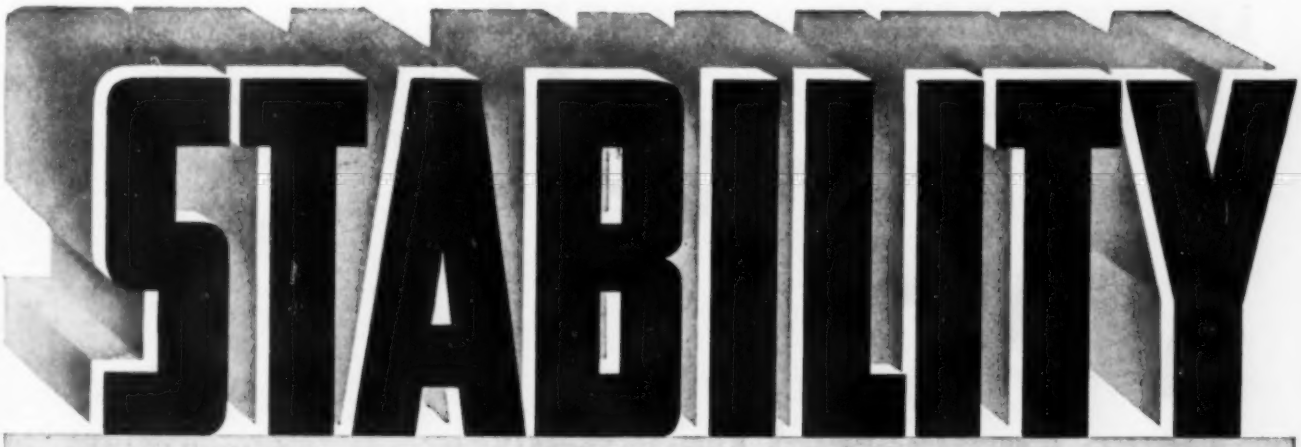

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Agriculture, Technical Bulletin No. 891. Price 20 cents.

Relationships of Cotton Fiber Properties to Strength and Elongation of Tire Cord. War Food Administration, Office of Marketing Services. Mimeographed.

Use of Commercial Fertilizers in Cotton Production. By J. J. Skinner. Department of Agriculture, Circular No. 726. Price 10 cents.

Feeding Cottonseed Products to Livestock. Department of Agriculture, Farmers' Bulletin 1179, revised 1945. Price 5 cents.

Forest Products Reports. The following mimeographed reports are available on request to Forest Products Laboratory, Madison, Wisconsin: No. R1490 Possibilities of Hardwoods for Pulping; No. R1491 High-Yield Sulfate and Soda Semichemical Pulps from Selected Southern Hardwoods and Southern Yellow Pine for the Production of Paperboards; No. 1551 Effect of Increased Moisture Content on the Shear Strength at Glue Lines of Box Beams and on the Glue-Shear and Glue-Tension Strengths of Small Specimens; No. R1492 Wood Research Pays High Dividends; No. R64 Outlets for Wood Waste, revised August 1945; No. R1489 Development of a Procedure for the Determination of the Properties of Cushioning Materials and Their Application in the Design of Cushions; No. R1488 Fire Resistance Tests of a Commercial Blanket Insulation; No. R1187 The Seasoning of Transverse Tree Sections; No. R1081 Partial List of Government Publications of Interest to Architects, Builders, Engineers, and Retail Lumbermen.

Chemicals to Kill Weeds and Diseases in Tobacco Beds. By Edward E. Clayton. Folder, illustration. Office of Information, Department of Agriculture, Washington 25, D. C.

Marine Surplus Seller. Issued Monthly by the Materials Disposal Section, Contract Settlement & Surplus Materials Division, U. S. Maritime Commission, Washington 25, D. C.

RECENT BOOKS & PAMPHLETS

Symposium on Analytical Colorimetry and Photometry. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 76 pages. Price $1. Papers presented at 47th annual meeting of ASTM last June.

Hydrocarbon Reactions in the Presence of Cracking Catalysts. By Gustav Egloff, Charles L. Thomas and others. Booklet No. 258, published by Universal Oil Products Co., 310 S. Michigan Ave., Chicago 4, Ill. 56 pages. Four papers reprinted from *J.A.C.S.*: Aliphatic Hydrocarbons; Hydrogen Transfer; Cyclohexene, Decalin, and Tetralin; Removal of Side Chains from Aromatics.

Condensed Mining Handbook of Utah. By Robert S. Lewis. Bulletin No. 29, published by Department of Mining and Metallurgical Research, University of Utah, Salt Lake City. 130 pages. Price $1. Mineral production and distribution by counties and mining districts; classified list of mining and allied companies; classified list of individuals and organizations as operators or owners.

A Bibliography on Cutting of Metals, 1864-1943. By O. W. Boston. Published by American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y. 547 pages. Price $6.50. Arranged alphabetically under each year. Indexed by author and by subject.

Procedure Handbook of Arc Welding Design and Practice. Eighth edition. Published by Lincoln Electric Co., Cleveland 1, Ohio. 1,282 pages. Price $1.50. Latest data on new arc welding methods and equipment.

The Machinists' and Draftsmen's Handbook. By A. M. Wagner and H. K. Arthur. Published by D. Van Nostrand Co., 250 Fourth Ave., New York, N. Y. 662 pages. Price $4.50. Reference book of mathematics, metals, tools, metal working, strength of materials, mechanics, etc.

Washington State Chemurgic Committee Proceedings. Published by Bureau of Business Research, College of Economics & Business, University of Washington, Seattle, Wash. 31 pages. Reprints from *Pacific Northwest Industry* of 9 papers dealing with recent chemurgic progress in Washington and Oregon, alcohol from wood byproducts, tannin from Western hemlock and other forest developments in these states.

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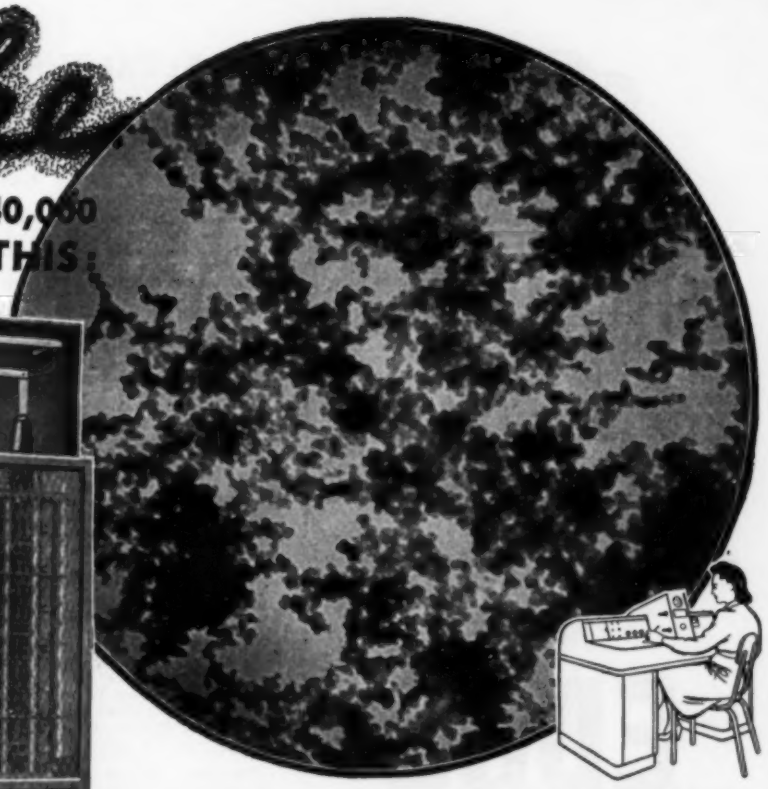

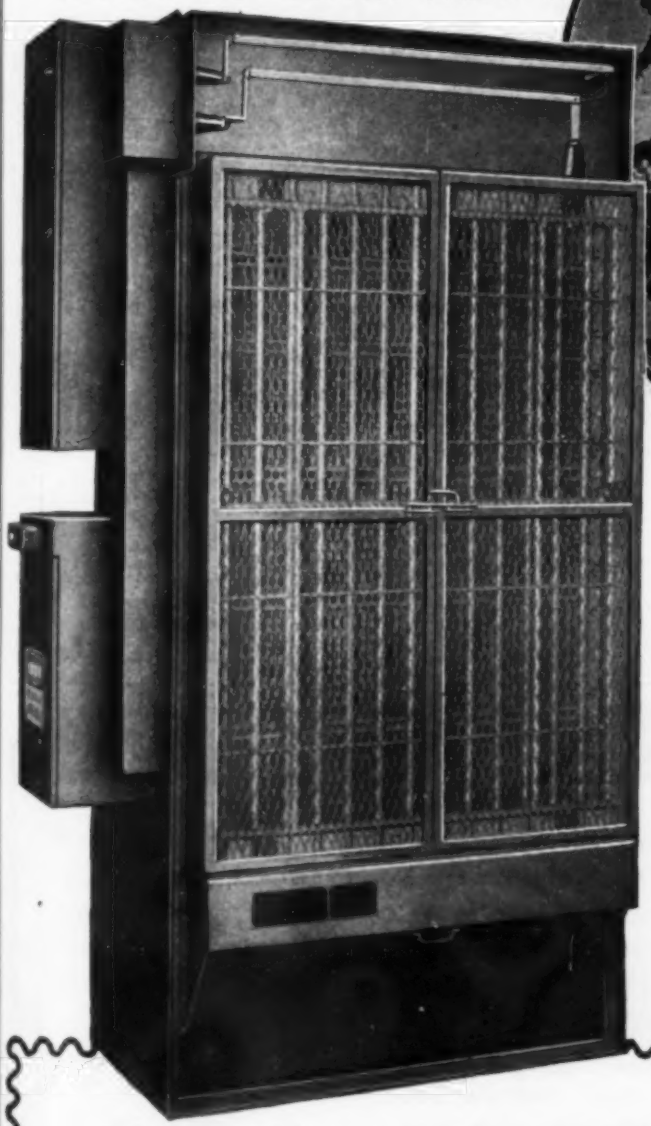

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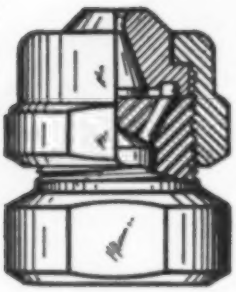

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterheads.

Adhesives. National Adhesives, 270 Madison Ave., New York 16, N. Y.—Booklet discussing resin adhesives contains information on the selection and use of synthetic resin adhesives for packaging, converting and assembling.

Air Cleaners. Vortox Co., Claremont, Calif. —Catalog on this firm's triple-action air cleaners which includes detailed investigation and data on selection of cleaners for internal combustion engines or air compressors. Contains drawings to show construction and operation of unit.

Air Motors. The Bellows Co., 861 E. Tallmadge Ave., Akron 10, Ohio—8-page booklet illustrates and describes the reciprocating air driven power units made by this company. Contains a section on design features, dimensions, sizes available, together with a list of possible applications. A description of accessories and special equipment is included.

Castings. Empire Steel Castings, Inc., Reading, Pa.—Bulletin 145-S. This bulletin contains a designation chart covering ISO cast stainless corrosion and heat resistance alloy steel castings.

Casting Resins. Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.—12-page bulletin giving complete technical details on the use of Durez casting resins. The various steps required in using these resins for the production of dies, jigs, fixtures, masking shields, etc., are given.

Chemicals. Philips Petroleum Co., Bartlesville, Okla.—Bulletin 118. 4-page leaflet describing the aliphatic sulphur chemicals furnished by this company. Includes information on availability, properties, typical reactions and suggested uses.

Clarifiers. Hardinge Co., York, Pa.—4-page leaflet illustrating this company's rectangular clarifier, flocculating equipment, classifiers, dewaterers, thickeners, and sand filters. Details of the equipment are illustrated by cross sectional drawings.

Color Engineering. McDougall-Butler Co., Inc., Evans, Water and Norton Sts., Buffalo 5, N. Y.—10-page booklet describing the effect of correct color schemes and how they improve the efficiency, safety, health and comfort of employees in factories, offices and institutions.

Condensers. Contract Engineering, 1024 Russ Bldg., San Francisco 4, Calif.—Folder giving details of this firm's recently announced steam condenser unit featuring the use of short sections of extruded tubing.

Control Valves. W. H. Nicholson & Co., Wilkes Barre, Pa.—Bulletin No. 645. 8-page folder illustrating control valves and steam traps for plastic molding presses. Details of construction, installation, and operation, for the various applications are given. Diagrams show how the equipment is actually hooked up. Also contains capacity tables, ordering information, and price lists.

Crotonic Acid. Shawinigan Products Corp., Empire State Bldg., New York, N. Y.—30-page booklet giving physical constants and properties, chemistry and typical reactions, together with possible uses and patent literature on crotonic acid. Over 280 references are given concerning this chemical product.

Dust Collectors. Thermix Engineering Co., First National Bank Building, Greenwich, Conn. —Bulletin 101. Booklet describes the Aerotec dust collector units and includes a discussion of the problem of fine dust collection in the range of 325 mesh screen or finer. Included are precipitating tests on various dusts in the industrial field.

Dust Removal. American Air Filter Co., Inc., 1st and Central Aves., Louisville 8, Ky.—Illustrated brochure describes the theory and

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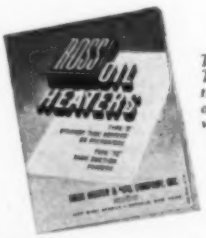

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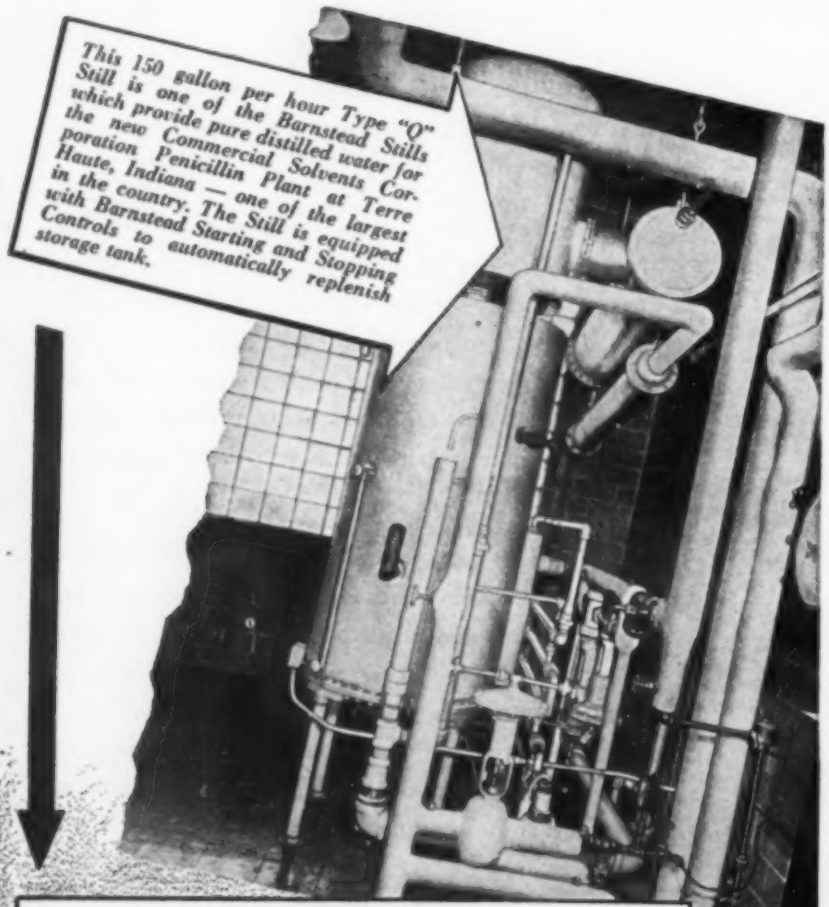

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practice of electronics in air filtration for removing entrained solids from air or gases by means of electric attraction. Various types of applications are discussed.

Electrical Equipment. Ideal Commutator Dresser Co., Sycamore, Ill.—36-page bulletin describing the maintenance of motors and generators. The maintenance and repair equipment for reconditioning electrical machinery is illustrated and described in detail.

Electronics. Eitel-McCullough, Inc., San Bruno Calif.—Bulletin A-612—58-page booklet entitled "Electronic Telesis" which explains in non-technical language fundamental principals and industrial application of electron tubes. Illustrated.

Endless Belts. The Manhattan Rubber Mfg. Division, Passaic, N. J.—Bulletin describes belt installations and discusses improved methods of splicing endless belts.

Engine Valves. Thompson Products, Inc., 8350 Wilcox Avenue, Bell, Calif.—Booklet containing simplified technical information on engine maintenance helps such as valve servicing, seat installation, clearances, grinding techniques, valve guide and seat removal, stem lubrication. Contains drawings designed to help both engineers and mechanics in installing and maintaining valves.

Equipment. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.—Three leaflets which answer the question of how to take a reconversion inventory of (1) centrifugal pumps, (2) V-belt drives and (3) electric motors. The various steps involved together with a check list covering the important points for each type of equipment are included.

Equipment. The Vapor Recovery Systems Co., Compton, Calif.—Catalog M-6. 66-page booklet illustrating relief valves, flame arresters, scupper valves, and other equipment.

Filters. Oliver United Filters, Inc., 33 W. 42nd St., New York 18, N. Y.—6-page leaflet illustrating the Oliver ring valve filter for use in pulp and paper mills. Cross sectional diagrams show the principle of operation and a flow diagram gives a typical hook-up. Various types of applications are discussed.

Fire Retardant. General Pacific Corp. 1800 South Hooper St., Los Angeles 21, Calif.—Bulletins 4 and 106—four-page bulletins that bring up to date application data on this firm's fire-retarding chemical solutions and "Firepel S" fire retardant coating material.

Flotation. Great Western Division, Dow Chemical Co., 310 Sansome St., San Francisco, Calif.—The "Flotation Index," an extensive bibliography of articles, papers, reports and books prepared on the subject of flotation from the year 1938 to date. Indexed by years, publication or patent assignee.

Fungicides. Nuodex Products Co., Inc., Elizabeth, N. J.—A new bulletin is available entitled "The Quantitative and Qualitative Determination of Copper, Zinc and Mercury in Treated Fibers and Fabrics."

Gears. Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 4, Wis.—Bulletin 53. 4-page illustrated leaflet describing the use of Ampco metal in gears.

Heating Equipment. D. J. Murray Mfg. Co., Wasau, Wis.—6-page folder describing the cast iron "fin" type radiation design and construction. Contains charts and illustrations with installation views of cast iron unit heaters, and includes dimensional drawings, capacity tables, etc.

Heat Treating. Ajax Electric Co., Inc., Frankford and Delaware Aves., Philadelphia 23, Pa.—Bulletin 113. 8-page bulletin illustrating and describing the process of isothermal heat treatment and the equipment used in this work. Principles of the process are described and illustrated by diagrams and a typical batch layout of the equipment is shown. Sizes and types of heat treating furnaces together with ordering information are given.

Industrial Furnaces. W. S. Rockwell Co., 50 Church St., New York 7, N. Y.—12-page catalog illustrating the various types of ovens and furnaces manufactured by this company. These include furnaces which are heated by gas, oil or electricity and which may be used with or without protective atmospheres. Details of the equipment are included with dimensions, specifications and operating data.

Industrial Vision. Bausch & Lomb Optical Co., Rochester, N. Y.—16-page brochure describing an industrial vision service which tests and evaluates the visual ability of individual workers for the purpose of improving efficiency.

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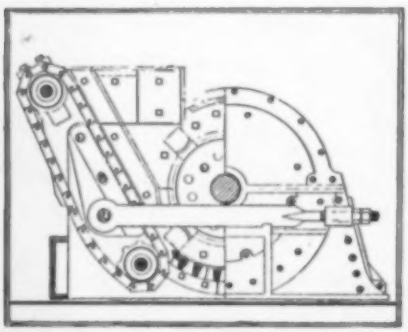

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Infra-red Heating. Carbomatic Corp., 117 W. 63d St., New York 23, N. Y.—10-page illustrated folder illustrating and describing the infra-red equipment for high temperature and low temperature heating. Equipment using both gas and electricity is furnished by this company.

Insecticides. Pennsylvania Salt Mfg. Co., Philadelphia, Pa.—4-page leaflet discussing the application of Penco grain fumigant to railroad cars, commercial elevators, and farm storages.

Instruments. North American Philips Co., Inc., 100 E. 42nd St., New York 17, N. Y.—12-page reprint entitled "Engineering-Design Development of X-Ray Spectrometer". This article discusses X-Ray diffraction principles, new instrument requirements, X-ray source, pulse conditioning, frequency meter circuits, counting meter circuits, meters and controls, and applications.

Instruments. Viking Instruments, Inc., Stamford, Conn.—Data sheet R-18. 4-page leaflet describing safety control systems for the shutdown of diesel engines. Contains instructions for installation and operation of this equipment on various applications.

Labels. Ever-Ready Label Corp., 141 E. 25th St., New York 10, N. Y.—32-page stock label catalog featuring this company's labels, which discusses new ideas for efficiency and economy by the use of labels.

Lead Pipe and Fittings. American Smelting & Refining Co., Lead Products Division, 120 Broadway, New York 5, N. Y.—24-page booklet featuring the prefabricated and standardized lead fittings manufactured by this company. Advantages of prefabricated fittings over lead burned fittings are discussed and several pages are devoted to a rather complete tabulation of the various sizes, shapes, prices, and specifications of these fittings. 20-page booklet illustrating and describing Asarco expanded lead-lined steel pipe. Features of this pipe are discussed and general specifications and precautions for use of this pipe are discussed. A price list is included.

Leather Packing. Graton & Knight Co., Worcester, Mass.—24-page booklet entitled "Packing Pointers" which consists of twelve discussions covering the fundamentals of packing design and application.

Lubricants. Merco Nordstrom Valve Co., 400 Lexington Ave., Pittsburgh 8, Pa.—Bulletin V105, Rev. 6. This new manual gives complete instructions for the application of valve lubricants for more than 100 specific valve services. More than 40 types of lubricants are recommended for various conditions of line fluid, temperature and pressure.

Materials Handling. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.—Folder No. 2088. 4-page leaflet describing and illustrating the oscillating trough conveyor made by this company. Features of this conveyor are discussed and a typical installation is outlined and illustrated.

Metal Finishes. The Enthone Co., New Haven 2, Conn.—8-page illustrated booklet describing coloring processes for copper and copper alloys and blackening processes for zinc and steel.

Meter Valves. Morganite Brush Co., Inc., Long Island City, N. Y.—6-page folder discussing Morganite liquid meter valves and slides. The features of Morganite which consist mainly of natural graphite, petroleum coke, lamp black and retort carbon combined with pitches, tars and other binders, are discussed. Chemical and physical properties together with the major applications of this material are given. Its usefulness as a material of construction for building liquid meter valves for various applications is featured.

Mixers. J. H. Day Co., Cincinnati 22, Ohio—Bulletin No. 378. 16-page catalog illustrating and describing rubber processing equipment. Specifications, capacities, sizes and dimensions are given in tabular form. Bulletin No. 453. 16-page catalog illustrating the mixing and blending equipment for use in the paint industry.

Oil Burner Service. Combustion Utilities Corp., 1451 Broadway, New York 18, N. Y.—2-page diagnosis chart for analyzing oil burner and diesel engine problems.

Packing. The Steel Improvement & Forge Co., 970 E. 64th St., Cleveland 14, Ohio—Bulletin No. 45. 8-page booklet describing

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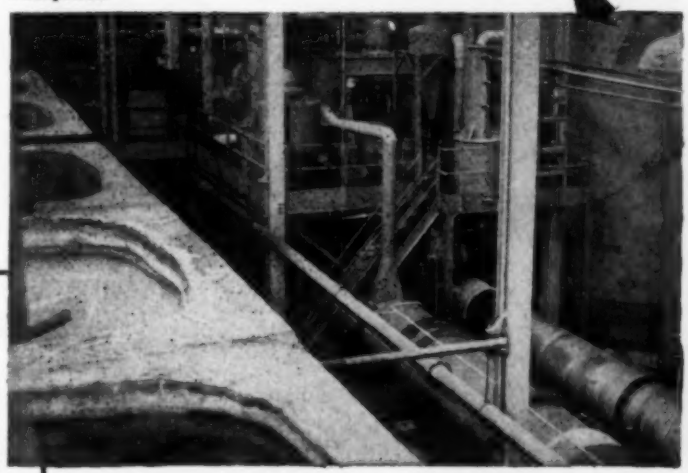

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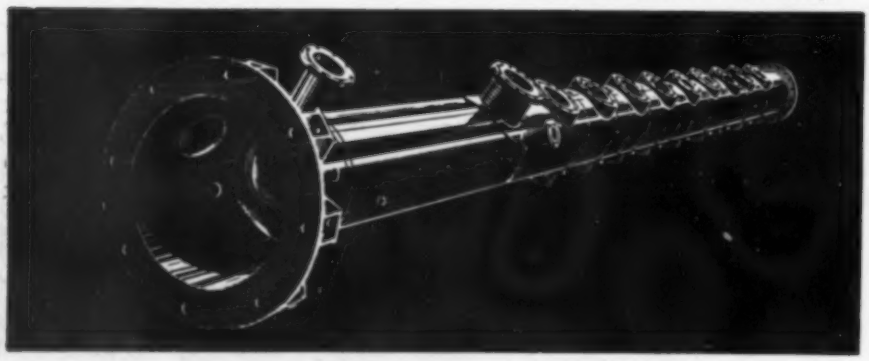

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Power Transmission. American Pulley Co., 4200 Wissahickon Ave., Philadelphia 29, Pa.—Bulletin describing the fractional horsepower Wedgbelt drives made by this company. It contains complete price list and specifications, together with four pages of condensed and simplified drive tables for a wide range of center distances and drive ratios.

Power Transmission. Dodge Mfg. Corp., Mishawaka, Ind.—Bulletin A-242. 18-page section, a supplement to Catalog No. 42, features some of the bearings and clutches manufactured by this company.

Power Transmission. D. O. James Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.—8-page catalog describing power transmission equipment manufactured by this company.

Pressure Lubrication. Durametallic Corp., 2104 Factory St., Kalamazoo 24 F., Mich.—4-page leaflet describing the Dura pressure system used for circulating lubricating oil at uniform pressures. Either turbine driven or motor driven pumps are used. A detailed illustrated description of the equipment and operation together with sizes and specifications is included.

Pressure Vessels. Lukens Steel Co., 20 Lukens Building, Coatesville, Pa.—12-page reprint entitled "The Economic Design of Modern Pressure Vessels" which presents analytical methods for determining the design of pressure tanks for specific working conditions.

Process Equipment. Dresser Industries, Inc., Terminal Tower, Cleveland 13, Ohio—12-page brochure which lists the various members of Dresser Industries, the products they manufacture and the services available.

Process Equipment. General American Transportation Corp., 420 Lexington Ave., New York 17, N. Y.—Bulletin No. 300. 8-page illustrated booklet describing the design, fabrication and erection of process equipment for the oil industry, including gas absorbers, fractionating towers, heat exchangers, lined vessels, stills, kilns and various other equipment.

Process Equipment. National Annealing Box Co., Washington, Pa.—24-page brochure describing the facilities and services offered by this company in the production of welded process equipment from open hearth, stainless, alloy, and clad steels.

Process Equipment. John Nooter Boiler Works Co., 1401 S. Second St., St. Louis 4, Mo.—8-page folder featuring the facilities of this company and the process equipment which they manufacture.

Process Equipment. Union Iron Works, Erie, Pa.—8-page illustrated booklet featuring the process equipment made by this company which includes evaporators, heat exchangers, condensers, autoclaves, distillation towers, etc.

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Pulverizers. Prater Pulverizer Co., 1825 South 55th Ave., Chicago 50, Ill.—12-page booklet describing the Prater dual-screen pulverizer. Application of this pulverizer in various industries is described and illustrated.

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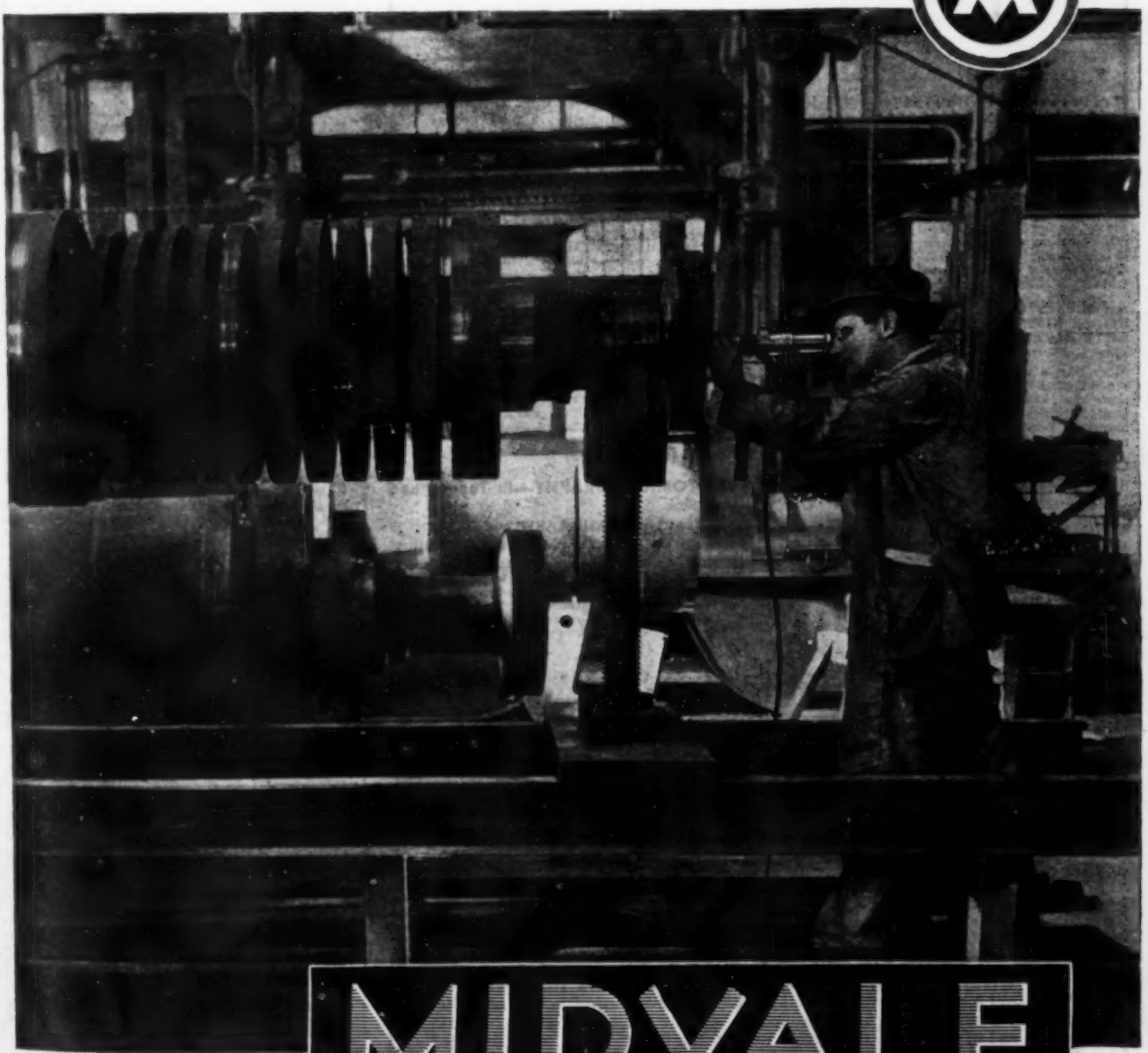

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Refractories. Gladding, McBean & Co., 1275 Harrison St., San Francisco, Calif.—Folder that lists and describes briefly properties and principal uses of this firm's line of refractory brick and concrete.

Separators. Merco Centrifugal Co., Hobart Building, San Francisco 4, Calif.—Bulletin 501. A booklet which explains and diagrams the operating principals and application of this firm's centrifugal separators for separating suspended solids.

Solvents. Standard Alcohol Co., 26 Broadway, New York, N. Y.—14-page booklet describing solvents derived from petroleum. Contains specifications, physical properties, shipping information, together with a short description of each of the solvents covered. 90-page booklet describing Petrohol (isopropyl alcohol). Various data are given in detail including uses, chemical behavior, pharmacology, physical properties and other general information.

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Storage Tanks. Chicago Bridge & Iron Co., 332 So. Michigan Ave., Chicago 4, Ill.—Bulletin E. 9-page leaflet illustrating and describing the Horton-spheroid and how its use reduces evaporation losses from volatile liquids. The reduction of filling, boiling and breathing losses are discussed. Various types of tanks, their application, principles of operation, maintenance, together with a table of standard capacities, are included.

Ultra-Violet Fluorescence. Ultra-Violet Products, Inc., 5205 Santa Monica Blvd., Los Angeles 27, Calif.—A series of eight bulletins of 4-6 pages each dealing with fluorochemistry, its principles and application in petroleum refining, criminology, scientific research, food science, mercury prospecting, education and biological sciences. Also a 16-page bulletin describing and illustrating the industrial, mining and analytical application of "Mineralight," the firm's ultra-violet lamp series. 23-page booklet listing mineral applications.

Valves. The William Powell Co., Cincinnati 22, Ohio—20-page catalog illustrating the corrosion resistant valves manufactured by this company. Principal types of valves together with the various metals and special alloys are shown. Considerable space is devoted to recommendations of valve materials for over 100 different corrosive fluids.

Valves and Fittings. Alloy Steel Products Co., Inc., Linden, N. J.—Complete catalog discusses the various types of valves and fittings made from stainless steel alloys by this company. Detailed specifications are given including mechanical properties, composition of alloys, etc.

Welding. Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 4, Wis.—Bulletin W-2. 20-page booklet describing welding with coated aluminum bronze welding rods for use in welding copper base alloys.

Welding Equipment. Air Reduction Sales Co., 60 E. 42d St., New York 17, N. Y.—16-page booklet illustrating and describing Airco gas welding and cutting supplies and accessories, including engineering data and current price list.

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Well Logging. Lane-Wells Co., 5610 South Soto St., Los Angeles 11, Calif.—12-page reprint entitled "Radioactivity Well Logging" which discusses the theory and practice of gamma ray measurement and neutron bombardment of formations as these relate to well logging by recently-developed radioactive principles. Contains extensive engineering data. Well illustrated by charts and diagrammatic drawings.

CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

DECLINE IN INDUSTRIAL PRODUCTION LOWERS DEMAND FOR CHEMICALS AND OTHER RAW MATERIALS

CLOSING OF many government plants which had been engaged in turning out products used in waging the war, has had a marked effect on the status of industry in general. It has been estimated that late in 1944, one-third of all domestic manufacturing facilities was devoted to producing strictly war materials. In November 1944, the Federal Reserve Board index for all industrial production stood at 232. By July of this year the index had fallen to 211 and for August the number was 188 or at about the level it had reached early in 1942. Since then, labor troubles have slowed up activities in some of the civilian industries, notably at steel mills and oil refineries and this has added to the declining trend of production. Judging from scattered data now available, the indexes for September and October will continue along a declining line.

While total consumption of chemicals has fallen considerably below the peak level, industrial consumption has maintained a fairly steady course. It was to be expected that consumption of raw materials at steel mills and oil refineries would be curtailed and that at least temporary dislocations would be encountered in the paint, textile, and plastics industries. Demand for fertilizer chemicals has been pushed up to record heights because of the wartime food program and revisions in the agricultural program for next season would indicate that fertilizers will not be able to go along at recent production rates. Yet there has been no drastic change and the wartime experience has done much to foster the use of fertilizer in a volume much larger than was the case in the prewar era and there is good reason to believe that fertilizer production and consumption will remain high so long as farmer-income is held at a satisfactory level. In recent weeks, while some industries have cut down their raw material requirements, the over-all effect has not been significant because such losses have been offset in great part by expanded operations in other industries. For instance, August figures show an appreciable gain in all branches of the paper industry as compared with the results of the preceding month. August output of glass containers was 9,296 thousand gross or a little ahead of the previous monthly high.

Then, too, are the favorable factors found in the rubber and plastics lines. Throughout the war period, a large part of rubber production was directed into channels designed for strictly war products. In the year that lies ahead, it is estimated that domestic consumption of rubber will be close to the wartime peak. The outlet for chemicals in the rubber trade may not hold up so well depending on the extent to which the synthetic product is made and used but it surely will be broader than it was in any prewar year.

For more than three years, the total outputs of certain types of plastics were taken by various government agencies. A good part of total production of all types moved in a similar way. It remains to be seen how closely civilian needs can come to keeping production up to the wartime volume although many new applications to which plastics will be put will help.

The *Chem. & Met.* index for consumption of chemicals for August is 187.33 compared with 184.94 for July. Last year the indexes were 186.17 and 176.63 respectively. That the August number this year was higher than it was a year ago was noteworthy in view of the sharp drop in activity at steel mills. Another factor was the unusually high output of superphosphate which reflected the more ample supply of sulphuric acid. Larger amounts of materials for civilian use soon should bring the *Chem. & Met.* index above that of the Federal Reserve Board.

Another development which may have a bearing on production of chemicals is found in plans which are under way for turning over some of the closed government plants to the control of private ownership. Some of these plans are well advanced and all of them would mean the resumption of chemical production if they are put through as proposed. At the butadiene-styrene plant near Pittsburgh there are four units and one of them already has been turned over to the production of other chemicals. The company which operated an ordnance plant in Kansas seeks to obtain the plant for production of a varied line of chemicals. These are typical cases where war plants are considered as potential producers of different types of regular industrial chemicals.

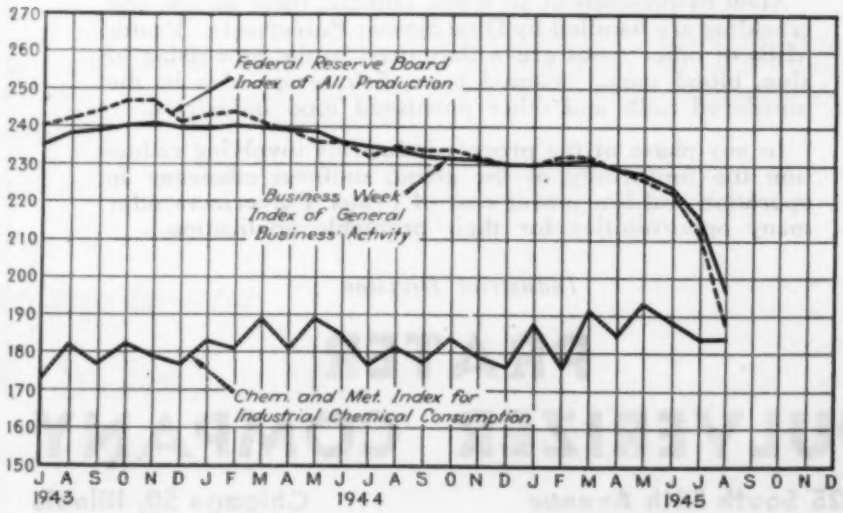
The War Production Board has just issued a very interesting report on the effect of the war on the industrial economy. A part of the report deals with the expansion of plant capacities during the war years. The extent of new building in the war period and the effect of such increased facilities upon the peacetime economy have been considered by all who have been attempting to estimate the future course of manufacturing industry as a whole or of its individual branches. The accompanying table sets forth the replacement value of plants in existence in 1939 and the value of new plants built in 1940-1944 inclusive.

The report states that perhaps the most conspicuous single source of increased industrial output during the war was the construction of new plants and the expansion and reequipment of old ones. From 1940 through 1944, more than $25 billions of new plant and equipment was added to our capacity, more that 60 percent of this total in the two years 1942 and 1943 alone. The government contributed somewhat above two-thirds of the aggregate investment. The cost of the new facilities equalled roughly one-half of the

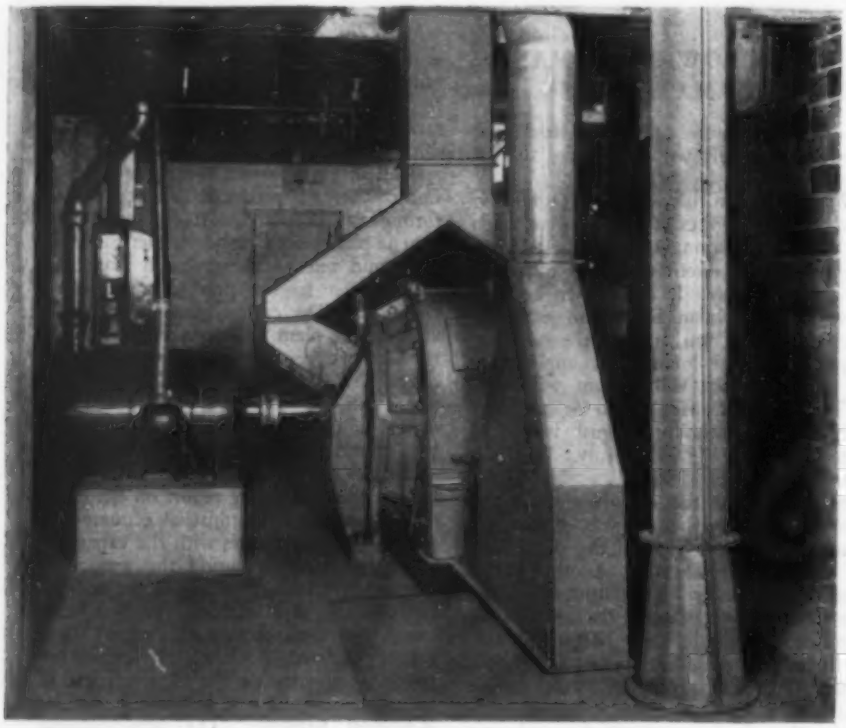
Chem. & Met. Index for Industrial Consumption of Chemicals

1935 = 100

	July revised	Aug.
Fertilizers	42.14	43.90
Pulp and paper	18.75	19.70
Petroleum refining	20.14	20.42
Glass	19.25	19.95
Paint and varnish	17.10	16.58
Iron and steel	12.73	10.78
Rayon	17.78	18.15
Textiles	9.38	10.12
Coal products	10.02	9.70
Leather	4.25	4.30
Industrial explosives	5.40	5.53
Rubber	3.00	3.00
Plastics	5.00	5.20
	184.94	187.33



PRATER DUAL SCREEN PULVERIZERS



meet many specialized needs of the Food Processing Industries

The processing of organic materials brings many specialized grinding problems, especially in utilization of by-products. The reduction requirements of many food processing plants have been submitted to Prater Service for solution primarily because the industry has had a long and successful experience with Prater Processing Equipment.

Meat by-products of all types, tankage, meat scraps, and crackling are handled by Dual Screen Pulverizers. Prater Mills of other types are widely used in the processing of glue, blood meal, steamed bone, fish scrap—also in the powdered milk and other powdered food industries.

In any phase of the process industries involving reduction the uniformity of the grind, uniform efficiency in operation and low power cost of Prater Pulverizers offer many opportunities for their profitable application.

Industrial Division

PRATER PULVERIZER COMPANY

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estimated gross replacement value of manufacturing plants and equipment in place in 1939. While exact measurement is not possible it would appear that industry's over-all capacity increased at least 40 percent since 1939.

Plans for full employment and real prosperity in the next few years generally are predicated upon the maintenance of something like our wartime rates in production of goods. What this objective would be may be inferred from the report which stated that production of industrial raw materials during the war rose more than 60 percent with about two-thirds of the total increase taking place in 1940 and 1941. Production of steel doubled between 1939 and 1944. Of other important materials, aluminum increased by nearly 400 percent; chemicals well over 200 percent; coal about 50 percent; and petroleum more than 30 percent. Late in 1944, about one-third of the total output of manufacturing industries consisted of munitions, that is of articles differing in kind from peacetime products as against only about one percent in 1939.

In analyzing this growth, it is pointed out that it started from a level almost equal to the high of the preceding ten years. It was stimulated and supported by what amounted to a guaranteed market for almost everything that could be produced and by the government's readiness to provide most of the fixed and much of the working capital needed in war production. These differences may be so important as to make our recent experience a diversion from the trend of development of the American industrial economy rather than a basis for future steady growth. The unprecedented wartime expansion may, in other words, be no more than a short-lived demonstration of the flexibility and power of American industry when put to a supreme test. The war has taught us how large our industrial potential really is.

Wartime Expansions of Manufacturing Plants*

Billion Dollars

	Replacement Value 1939 Plants	Additions 1940-44†
Food	$6.7	$1.3
Tobacco	0.3	‡
Textiles	3.9	0.6
Apparel	0.4	‡
Leather	0.4	‡
Rubber	0.8	0.1
Lumber	1.3	0.3
Furniture	0.9	0.1
Paper	2.3	0.4
Printing and publishing	1.8	0.2
Chemicals	3.9	5.4
Petroleum and coal products	4.0	1.0
Stone, clay and glass	2.4	0.4
Iron and steel	5.6	4.9
Nonferrous metals	1.4	1.7
Electrical machinery and equipment	1.1	0.5
Machinery	3.2	0.9
Autos and equipment	2.8	0.9
Transportation equipment except autos	1.1	0.6
Other	1.2	0.2
Total	49.0	25.6

* Original cost of manufacturing plants and equipment (including land costs put in place, adjusted to October 1943 price levels. † The total is broken down by years as follows: 1940, 2.7; 1941, 4.7; 1942, 8.7; 1943, 6.4; 1944, 3.1. ‡ Less than 0.005.

One of the FOUR Major Properties of

PETRONATE

(OIL-SOLUBLE PETROLEUM SULFONATE)

★ **EXAMPLES** ★

USE	PRIMARY FUNCTION OF PETRONATE	SECONDARY FUNCTION
*Leather Processing	Emulsifying Agent	Increases Softness of Leather
Metal Drawing Compounds	Dispersing Agent for Filler	Acts as Detergent
Dry Cleaning Compounds	Linking Agent for Water and Solvent	Loosens Dirt Absorbed by Fabric
*Paint and Varnish Removers	Aids in Cutting Paint Film	Retards Evaporation
Soldering Pastes	Homogenizing Agent for Flux Ingredients	Acts as Wetting Agent for Metal Surfaces
*Synthetic Rubber Manufacture	Emulsifying Agent for Co-polymers	Acts as Dispersing Agent for Filler
Crude Oil Emulsion Splitting	Reverting Agent for Water-in-Oil Emulsions	Aids in Wetting Out Salts and Solids
*Paper Processing	Wetting Agent for Pulp	Aids Sizing
Cordage Oils	Scouring Agent	Improves Lubricating Characteristics
Machine and Floor Cleaners	Solubilizing Agent for Oil and Grease Deposits	Acts as Emulsifying Agent

#3

WETTING and DISPERSION of LIQUID-SOLID SYSTEMS with PETRONATE

*Subject to further development.

How Petronate may be adapted to one or more of your manufacturing processes, present or contemplated, is suggested by the typical functions of this highly purified oil-soluble petroleum sulfonate (mahogany soap) listed above.

Petronate has won widespread acceptance as an important basic material for many industrial applications related to its four major functional properties:

1. **Emulsification and Dispersion of Liquids.**
2. **Dispersion and Wetting of Solids.**
3. **Wetting and Dispersion of Liquid-Solid Systems.**
4. **Inhibition of Rust and Corrosion.**

As indicated, Petronate lends itself to a great variety of uses—actual and potential. Its functions in the first and second of these logical fields were covered in earlier examples (*reprints on request*). The fourth group will be presented in the next issue of this series.

Meanwhile, the opportunity to study specific problems with you will be welcomed, and a sample of Petronate for laboratory experimentation will be supplied promptly upon request.

FLASH BULLETIN! Now that the war is over, PETRONATE is again available for general manufacturing and processing requirements. Details on request.

Typical Analysis of PETRONATE

Sulfonates	62%
Mineral Oil	35%
Inorganic Salts	none
Water	3%
	100%

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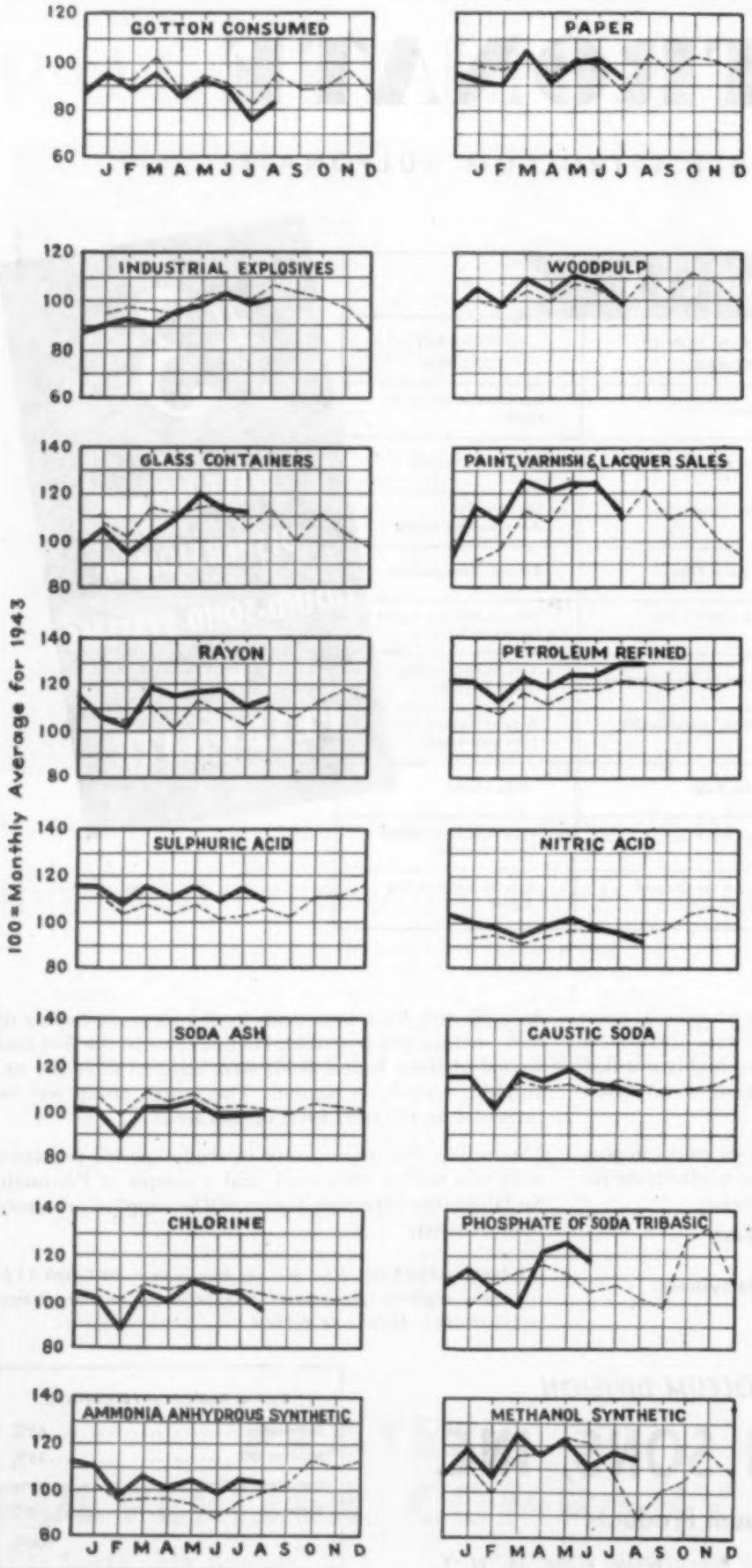
PRODUCTION AND CONSUMPTION TRENDS



BASED ON latest available figures, the trend for chemical production has turned somewhat downward, this referring to regular industrial plants and not to government plants, most of which have been closed. This condition was brought about by the cancellation of government contracts either for chemicals or for finished products for which chemicals are essential materials. In other words, war industries drew upon industrial plants for raw material supplies and when this business was cut off it had the general effect of cutting down the output of many raw materials.

In the other direction, the release of government controls made many raw materials available for the manufacture of civilian goods. This is shown in larger outputs of certain pigments and chemical dry colors which improved their position in the latter part of August. The cut in government requirements also had the effect of threatening the market with large surplus stocks. This is particularly true of different solvents and the price tone for these materials has been weak accordingly with the implication that production schedules will be pared down until a better balance has been reached between supply and demand. Rubber grades of carbon black also are making a good showing even though production has been running high enough to relieve the recent shortage and to permit of the accumulation of reserve stocks.

As for the chemical-consuming industries, the outlook is regarded as favorable although the immediate situation has been clouded by labor troubles, scarcity of workers, and delays in securing needed parts for overworked equipment. In some cases scarcity of materials still is a factor.

Corroders have been granted larger stocks of lead but the quota is not yet large enough to permit white lead production in the volume desired. Drying oils are in a little better position but market conditions are far from normal. Some of the edible oils also are in limited supply but the New York Produce Exchange has approved a revised trading contract for futures in soybean oil which is an indication that supplies of that oil are expected to be available in large volume. The supply of rosin reserved for military use is being turned over to regular consuming industries and new quotas are being made for civilian use in the final quarter of the year.

For the present at least an ample supply of wood pulp is in prospect and controls over its use and delivery have been removed. A study of requirements for the fourth quarter revealed that pulp needed for paper, paperboard, etc. was 3,136,000 tons while the visible supply shows up as 3,159,000 tons of which 2,631,000 tons was represented by domestic production and the remainder by exports. In the final quarter of last year domestic pulp production was only 2,398,648 tons.

Synthetic fibers are finding a growing market and the plans for increasing productive facilities clearly indicates the trend for these products. Production facilities for synthetic resins also are to be expanded in order to meet consuming needs.

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We are able and eager to do more. One inevitable result of Revere's war effort has been that not only our ability to produce, but our ability to give service, have been expanded many times. Revere research has probed further and deeper. Revere Technical Advisors are armed with greater knowledge and experience. New methods, metals and machines may save precious time or cut all-important cost for users of our metals.

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United States Production of Certain Chemicals

July 1945, July 1944 and Seven-Month Totals for 1945 and 1944

Chemical and Basis	Units	July 1945	July 1944	Total, First 7 Months 1945	Total, First 7 Months 1944
Aluminum chloride:					
Anhydrous & crystal (100% $AlCl_3$)	M lb.	4,770	4,397	35,544	34,149
Solution (32° Be)	M lb.	639	827	6,813	5,844
Ammonia, synthetic anhydrous (100% NH_3)[1]	Tons	47,431	42,927	330,136	301,189
Ammonium chloride (100% NH_4Cl)	M lb.	5,233	4,510	38,033	33,127
Barium sulphate (100% $BaSO_4$)	M lb.	4,531	4,043	33,399	33,744
Bleaching powder (35-37% avail. Cl_2)	M lb.	2,126	3,094	16,447	33,776
Calcium acetate (80% $Ca(C_2H_3O_2)_2$)	M lb.	591	602	4,425	6,641
Calcium arsenate (100% $Ca_3(AsO_4)_2$)	M lb.	4,606	8,228	19,828	34,508
Calcium hypochlorite (70% avail. Cl_2)	M lb.	1,273	1,091	8,964	8,149
Calcium phosphate: monobasic (100% $CaH_4(PO_4)_2$)	M lb.	4,693	4,472	35,491	35,785
Dibasic (100% $CaHPO_4$)	M lb.	3,589	3,194	24,800	32,292
Carbon, activated	M lb.	5,267	4,979	36,409	35,658
Carbon black (channel): rubber grade	M lb.	43,700	31,216	207,932	213,923
Other grades	M lb.	2,647	2,759	18,518	15,527
Chlorine	Tons	105,189	108,657	729,183	743,381
Chrome green (C. P.)	M lb.	411	413	3,305	3,610
Chrome yellow & orange (C. P.)	M lb.	2,954	2,725	23,043	19,868
Hydrochloric acid (100% HCl)	Tons	35,891	32,325	254,453	210,717
Hydrogen peroxide (100 volumes)	M lb.	2,514	2,130	18,569	16,214
Iron blue	M lb.	723	787	5,470	5,305
Lamp black	M lb.	1,283	716	8,817	8,537
Lead oxide: red (C. P.)	M lb.	7,748	7,460	67,437	61,106
Yellow (C. P.)	M lb.	26,466	22,159	193,933	178,724
Methanol, synthetic (100% CH_3OH)	M gal.	6,318	5,838	44,496	43,111
Molybdate chrome orange (C. P.)	M lb.	59	129	841	840
Nitric acid (100% HNO_3)	Tons	38,944	38,974	279,322	267,661
Phosphoric acid (50% H_3PO_4)	Tons	60,002	57,324	395,671	422,183
Potassium bichromate & chromate (100%)	M lb.	459	506	3,938	4,633
Potassium hydroxide (100% KOH)	Tons	4,738	3,495	31,476	25,396
Soda ash (commercial sodium carbonate):					
Ammonia-soda process (98-100% Na_2CO_3)					
Total wet & dry[2]	Tons	358,217	373,921	2,561,469	2,681,790
Finished light[3]	Tons	192,842	201,826	1,374,420	1,465,140
Finished dense	Tons	121,122	121,159	813,119	849,601
Sodium bicarbonate (100% $NaHCO_3$)	Tons	11,332	11,802	96,822	94,743
Sodium bichromate & chromate	Tons	6,244	6,629	46,459	48,927
Sodium bisulphite (100% $NaHSO_3$)	M lb.	1,438	2,976	21,018	23,774
Sodium hydrosulphide (100% NaSH)	M lb.	2,446	2,233	15,419	15,613
Sodium hydrosulphite (100% $Na_2S_2O_4$)	M lb.	3,184	3,113	22,260	24,739

(*Table continued on p. 295*)

Data for this tabulation have been taken from the "Facts for Industry" series issued by Bureau of the Census and WPB Chemicals Bureau. Production figures represent primary production and do not include purchased or transferred material. Quantities produced by government-owned arsenals, ordnance works and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. [1] Includes a small amount of aqua ammonia. [2] Total wet and dry production including quantities diverted for manufacture of caustic and bicarbonate, and quantities processed to finished light and finished dense. [3] Not including quantities converted to finished dense. [4] Data collected in cooperation with Bureau of Mines. [5] Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6] Includes oleum grades; excludes spent acid.

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U. S. Chemical Production (Continued from p. 294)

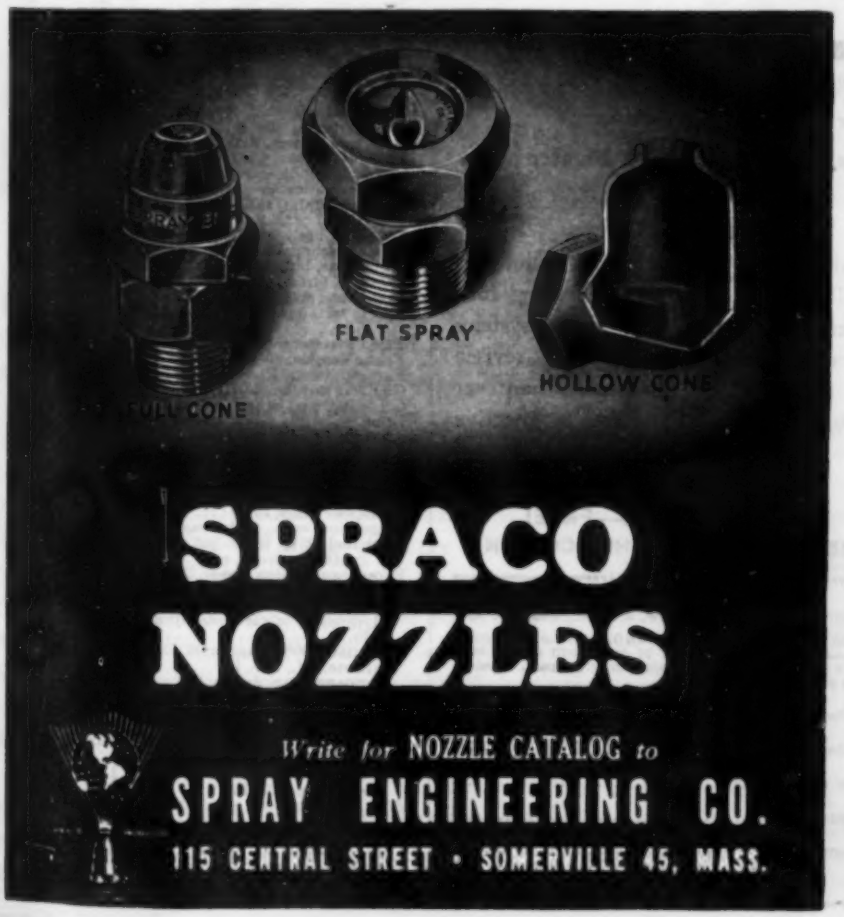
Chemical and Basis	Units	July 1945	July 1944	Total, First 7 Months 1945	Total, First 7 Months 1944
Sodium hydroxide (100% NaOH):[4] electrolytic process					
Liquid	Tons	100,920	103,433	691,672	700,032
Solid	Tons	19,302	.....	132,191	.....
Lime-soda process					
Liquid	Tons	56,724	58,113	432,383	396,749
Solid	Tons	19,455	.....	141,865	.....
Sodium silicate (anhydrous)[5]	Tons	32,060	38,374	265,621	241,871
Sulphuric acid (100% H_2SO_4):[4] chamber process	Tons	251,504	249,775	1,887,971	1,868,601
Net contact process[6]	Tons	511,627	442,910	3,398,869	3,033,491
White lead: basic lead carbonate	Tons	3,251	5,901	23,687	48,531
Basic lead sulphate	Tons	918		6,853	
Zinc yellow (zinc chromate) (C. P.)	Tons	1,309	.....	11,092	.....

United States Production of Certain Synthetic Organic Chemicals

July 1945, July 1944 and Seven-Month Totals for 1945 and 1944

Item	July 1945	July 1944	Total, First 7 Months 1945	Total, First 7 Months 1944
Acetanilide, technical and U. S. P.	595,884	147,784	3,002,165†	2,896,507*
Acetic acid, synthetic[3]	20,459,033	21,870,652	162,345,956	171,311,016
Acetic acid, natural[3]	2,896,968	3,383,084	20,825,709	23,758,158
Acetic anhydride[3]	43,866,916	39,112,652	316,667,234	283,144,609
Acetylsalicylic acid, aspirin	813,540	619,290	6,196,165	5,278,706
n-Butyl acetate	4,709,465	5,337,323	40,221,151	43,298,443
Creosote oil, tar distillers[4]	9,840,860	8,313,013	77,196,867	73,921,435
Creosote oil, byproduct[3, 4]	3,051,086	3,448,501	21,768,001	23,356,213
Cresols, meta-para[7]	544,690	435,372	4,506,548	4,046,756
Cresols, ortho-meta-para[7]	813,723	808,773	5,802,754*	5,807,002
Cresylic acid, crude	2,347,723	2,274,014	15,972,546	14,595,662
Cresylic acid, refined[7]	2,375,299	3,552,622	17,440,024	24,144,198
Diethyl ether	7,223,495	4,988,529	54,992,768	35,305,006
Ethyl acetate	9,455,790	7,771,456	64,497,550	61,539,964
Methyl chloride, all grades	2,459,751	2,047,789	17,622,063	12,721,695
Naphthalene, coke-oven operators[3, 4, 8]	7,715,663	8,239,513	53,034,931	61,025,588
Naphthalene, tar distillers[4, 8, 9]	17,014,230	15,741,231	117,603,097	112,282,598
Naphthalene, refined[10]	6,685,383	6,350,584	41,517,645	51,518,047
Oxalic acid, technical	1,714,185	1,384,572	11,909,618	10,312,664
Phenobarbital and sodium salts	24,442	12,258	170,027	147,037
Phthalic anhydride	10,934,029	10,643,510	77,959,479	70,855,397
Sulfa drugs, total[11]	539,698	166,450	3,420,797	3,206,555

All data in pounds except creosote oil (gal.) Statistics collected and compiled by U. S. Tariff Commission except where noted. [1]Excludes statistics on recovered acid which are confidential. [2]Acid produced by direct process from wood and from calcium acetate. [3]All acetic anhydride including that from acetic acid by vapor-phase process. [4]Product of distillers who use purchased coal tar only. [5]Product of byproduct coke-oven operators only. [6]Statistics collected and compiled by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Statistics combine three grades: solidifying at less than 74 deg. C.; 74 to less than 76; 76 to less than 79. [9]Statistics represent production for sale only for less than 74 grade; for other two grades they represent for sale and for consumption within producing plant. [10]79 deg. C. and over. [11]Includes data for acetylsulfathiazole, both as drug and intermediate, resulting in appreciable unavoidable duplication. *Six-month total. †Five-month total.



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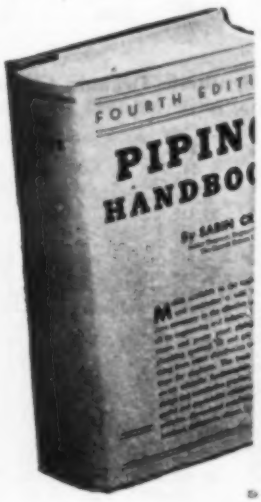

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CHEM. & MET.

Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

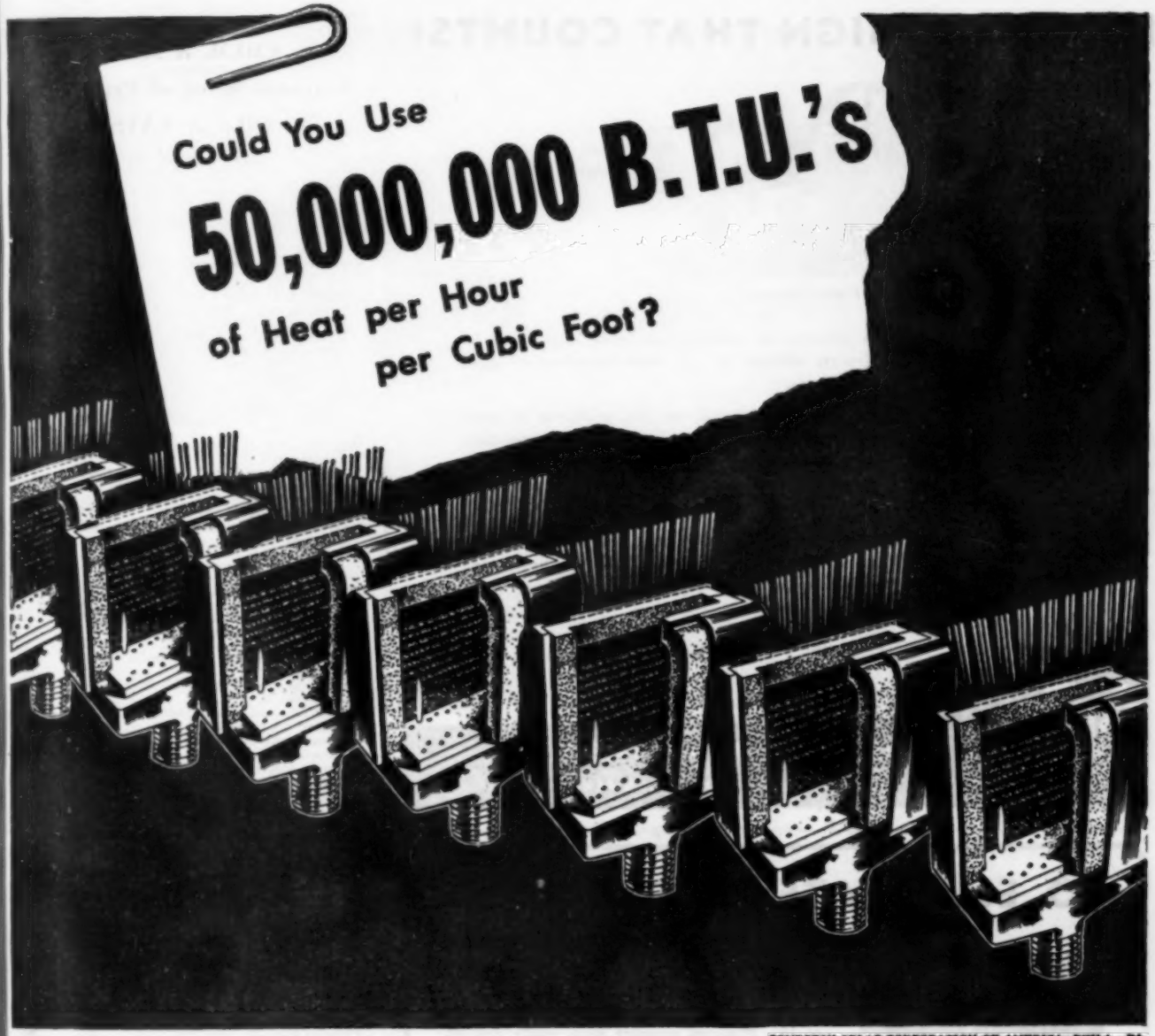
This month	**108.72**
Last month	108.63
October, 1944	109.40
October, 1943	109.10

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to October 15.

INDUSTRIAL CHEMICALS

Acetone, tanks, lb	$0.06 –
Acid, acetic, 28%, bbl., 100 lb.	3.38 – $3.63
Boric, bbl., ton	109.00 –113.00
Citric, kegs, lb	.20 – .23
Formic, cbys., lb	.10½– .11
Hydrofluoric, 30%, drums, lb	.08 – .085
Lactic, 44%, tech., light, bbl., lb.	.073– .075
Muriatic, 18°, tanks, 100 lb	1.05 –
Nitric, 36°, carboys, lb	.05 – .05½
Oleum, tanks, wks., ton	18.50 – 20.00
Oxalic, crystals, bbl., lb	.11½– .12½
Phosphoric tech., tanks, lb	.04 –
Sulphuric, 60°, tanks, ton	13.00 –
Tartaric, powd., bbl., lb	.70½–
Alcohol, amyl	–
From pentane, tanks, lb	.13½–
Alcohol, butyl, tanks, lb	.10½– .18½
Alcohol, ethyl, denatured, 190 proof	–
No. 1 special, tanks, gal., wks.	.50 –
Alum, ammonia, lump, lb	.04½–
Aluminum sulphate, com. bags 100 lb.	1.15 – 1.40
Ammonia, anhydrous, cyl., lb	.14½–
tanks, ton	59.00 – 69.00
Ammonium, carbonate, powd., casks, lb	.09½– .10
Sulphate, wks., ton	28.20 –
Amyl acetate, tech., from pentane, tanks, lb	.145–
Aqua ammonia, 26°, drums, lb	.02½– .03
tanks, ton	65.00 –
Arsenic, white, powd., bbl., lb	.04 – .04½
Barium carbonate, bbl., ton	65.00 – 75.00
Chloride, bbl., ton	75.00 – 78.00
Nitrate, casks, lb	.09½– .11
Blanc fix, dry, bags, ton	60.00 – 70.00
Bleaching powder, f.o.b., wks., drums, 100 lb	2.50 – 3.00
Borax, gran., bags, 100 lb	45.00 –
Calcium acetate, bags 100 lb.	3.00 –
Arsenate, dr., lb	.07½– .08
Carbide, drums, ton	50.00 –
Chloride, flake, bags, del., ton	18.50 – 25.00
Carbon bisulphide, drums, lb	.05 – .05½
Tetrachloride, drums, gal	.73 – .80
Chlorine, liquid, tanks, wks., 100 lb	1.75 – 2.00
Copperas, bgs., f.o.b., wks., ton	17.00 – 18.00
Copper carbonate, bbl., lb	.19½– .20
Sulphate, bbl., 100 lb	5.00 – 5.50
Cream of tartar, bbl., lb	.57 –
Diethylene glycol, dr., lb	.14½– .15½
Epsom salt, dom., tech., bbl., 100 lb	1.80 – 2.00
Ethyl acetate, tanks, lb	.107–
Formaldehyde, 40%, tanks, lb	.032–
Furfural, tanks, lb	.09½–
Glaubers salt, bags, 100 lb	1.05 – 1.10
Glycerine, c.p., drums, extra, lb	.17½– .17½
Lead:	
White, basic carbonate, dry, casks, lb	.08½–
Red, dry, cck., lb	.09½–
Lead acetate, white crys., bbl., lb.	.12½– .13
Lead acetate, powd., bag., lb	.11½– .12
Lithopone, bags, lb	.04½– .04½
Magnesium carb., tech., bags, lb.	.07½– .08
Methanol, 95%, tanks, gal	.60 –
Synthetic, tanks, gal	.24 –
Phosphorus, yellow, cases, lb	.23 – .25
Potassium bichromate, casks, lb.	.10½– .10½
Chlorate, pwd., lb	.09½– .12
Hydroxide (caustic potash) dr., lb	.07 – .07½
Muriate, 60%, bags, unit	.53½–
Nitrate, ref., bbl., lb	.08 – .09
Permanganate, drums, lb	.19½– .20
Prussiate, yellow, casks, lb	.16 – .17
Sal ammoniac, white, casks, lb	.0515– .06
Salsoda, bbl., 100 lb	1.00 – 1.05
Salt cake, bulk, ton	15.00 –
Soda ash, light, 58%, bags, contract, 100 lb	1.05 –
Dense, bags, 100 lb	1.15 –
Soda, caustic, 76% solid, drums, 100 lb	2.30 – 3.00
Acetate, del., bbl., lb	.05½– .06
Bicarbonate, bbl., 100 lb	1.70 – 2.00
Bichromate, bags, lb	.07½– .08
Bisulphate, bulk, ton	16.00 – 17.00
Bisulphite, bbl., lb	.03 – .04



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FOR ALL
INDUSTRIAL HEATING

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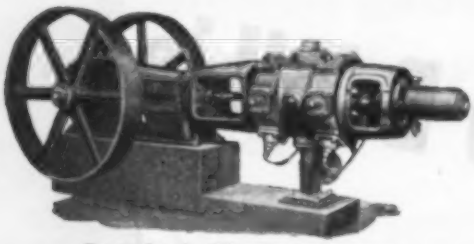

Pennsylvania Oilfreair Compressor

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PENNSYLVANIA *Oilfreair* design has solved this problem by providing for a *fully floating* piston. This is accomplished by extending the piston rod into an outboard bearing which makes possible crosshead support of the rod at both the main frame and outboard end of the compressor.

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Descriptive bulletin 188 on request

PPC

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BUSHKILL PARK ROAD, EASTON, PENNA

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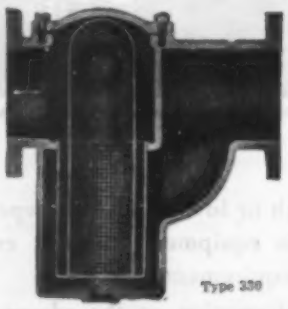

Type 330

Positive protection for pipe lines and equipment in chemical water, oil, steam applications . . . basket, "Y" and straight-flow strainers from ½" to 18". Minimum pressure drop, easily cleaned. Bodies of Standard or X-heavy semi-steel, bronze, galvanized or series 15, 30, 40 or 60 cast steel. Baskets are bronze, monel, stainless steel, wire cloth or special alloys. Write for Catalog, 66-C.

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One of many designs to meet many problems.

Dryers
Calciners
Coolers

CHEM. & MET.

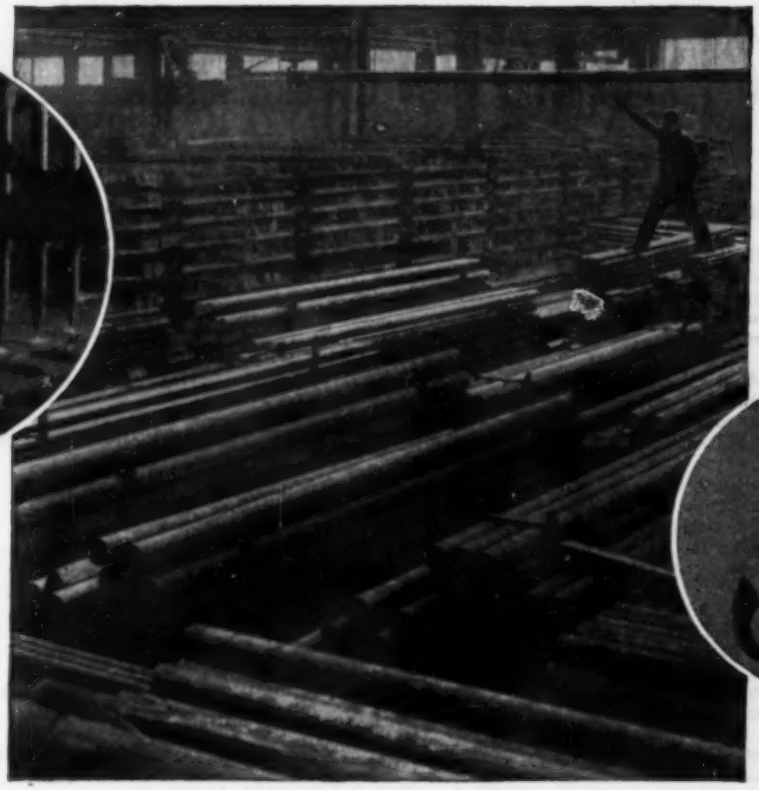
Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

This month	145.63
Last month	145.63
October, 1944	145.04
October, 1943	145.58

Chlorate, kegs, lb	$0.06½ –	$0.06½
Cyanide, cases, dom., lb	.14½ –	.15
Fluoride, bbl., lb	.07 –	.08
Hyposulphite, bags, 100 lb	2.25 –	2.50
Metasilicate, bbl., 100 lb	2.50 –	2.65
Nitrate, bulk, ton	27.00 –	
Nitrite, casks, lb	.06½ –	.07
Phosphate, tribasic, bags, lb	2.70 –	
Prussiate, yel., bags, lb	.10½ –	.11
Silicate, 40°, dr., wks., 100 lb	.80 –	.85
Sulphite, crys., bbl., lb	.02½ –	.02½
Sulphur, crude at mine, long ton	16.00 –	
Dioxide, cyl., lb	.07 –	.08
Dioxide, tanks, lb	.04 –	
Tin crystals, bbl., lb	.39½ –	
Zinc chloride, grain, bbl., lb	.05½ –	.06
Oxide, lead free, bags, lb	.07 –	
Oxide, 5% leaded, bags, lb	.07 –	
Sulphate, bbl., cwt	3.85 –	4.00
OILS AND FATS		
Castor oil, No. 3 bbl., lb	$0.13½ –	$0.14½
Chinawood oil, tanks, lb	.38½ –	
Coconut oil, ceylon, dr. N. Y., lb	.08¾ –	
Corn oil crude, tanks (f.o.b. mill), lb	.12½ –	
Cottonseed oil crude (f.o.b. mill), tanks, lb	.12½ –	
Linseed oil, raw, car lots, bbl., lb	.15½ –	
Palm, casks, lb	.08½ –	
Peanut oil, crude, tanks (mill), lb	.12½ –	
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tanks, lb	.11½ –	
Menhaden, light, pressed, dr. lb	.13 –	
Crude, tanks (f.o.b. factory) lb	.08¾ –	
Grease, yellow, loose, lb	.08½ –	
Oleo stearine, lb	.09½ –	
Oleo oil, No. 1, lb	.11½ –	
Red oil, distilled, bbl., lb	.13 –	
Tallow extra, loose, lb	.08½ –	
COAL-TAR PRODUCTS		
Alpha-naphthol, crude, bbl., lb	$0.52 –	$0.55
Alpha-naphthylamine, bbl., lb	.32 –	.34
Aniline oil, drums, extra, lb	.11½ –	.12½
Aniline salts, bbl., lb	.22 –	.24
Benzaldehyde, tech., dr., lb	.45 –	.50
Benzidine base, bbl., lb	.70 –	.73
Benzoic acid, USP, kegs, lb	.54 –	.56
Benzol, 90%, tanks, works, gal	.15 –	
Benzyl chloride, tech., dr., lb	.22 –	.24
Beta-naphthol, tech., drums, lb	.23 –	.24
Cresol, USP, dr., lb	.10½ –	
Cresylic acid, dr., wks., gal	.81 –	.82
Diphenyl, bbl., lb	.15 –	
Diethylaniline dr., lb	.40 –	.45
Dinitrotoluol, bbl., lb	.18 –	.19
Dinitrophenol, bbl., lb	.22 –	.23
Dip oil, 15%, dr., gal	.23 –	.25
Diphenylamine, dr., f.o.b. wks., lb	.25 –	
H acid, bbl., lb	.45 –	.50
Hydroquinone, bbl., lb	.90 –	
Naphthalene, flake, bbl., lb	.07 –	.07½
Nitrobenzene, dr., lb	.08 –	.09
Para-cresol, bbl., lb	.41 –	
Para-nitraniline, bbl., lb	.47 –	.49
Phenol, USP, drums, lb	.10 –	.11
Picric acid, bbl., lb	.35 –	.40
Pyridine, dr., gal	1.55 –	1.60
Resorcinol, tech., kegs, lb	.65 –	.70
Salicylic acid, tech., bbl., lb	.26 –	.28
Solvent naphtha, w.w., tanks, gal	.26 –	
Toluidin, bbl., lb	.96 –	.98
Toluol, drums, works, gal	.32 –	
Xylol, com., tanks, gal	.25 –	
MISCELLANEOUS		
Casein, tech., bbl., lb	$0.21 –	$0.24
Dry colors		
Carbon gas, black (wks.), lb	.0335 –	.50
Prussian blue, bbl., lb	.36 –	.37
Ultramarine blue, bbl., lb	.11 –	.28
Chrome green, bbl., lb	.23 –	.33
Carmine, red, tins, lb	4.60 –	4.75
Para toner, lb	.75 –	.80
Vermilion, English, bbl., lb	2.50 –	2.60
Chrome, yellow, C.P., bbl., lb	.16 –	.17
Gum copal, Congo, bags, lb	.09 –	.53
Manila, bags, lb	.09 –	.11
Damar, Batavia, cases, lb	.10 –	.22
Kauri, cases, lb	.18 –	.60
Magnesite, calc, ton	64.00 –	
Pumice stone, lump, bbl., lb	.05 –	.07
Rosin, H., 100 lb	7.43 –	
Shellac, orange, fine, bags, lb	.46 –	
Bleached, bonedry, bags, lb	.42 –	
T. N. bags, lb	.35 –	
Turpentine, gal	.91 –	

Ryerson Flame cutters, high-speed hack saws and shears prepare steel quickly and accurately.



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1. Where to Find Largest Stocks—The thousands of kinds, shapes and sizes of steel in eleven Ryerson Steel-Service plants are still the largest, most complete stocks available anywhere. This means that, despite shortages in some sizes, you can be more certain of getting the steel you need from Ryerson.

2. Technical Service—For more than 100 years Ryerson has supplied steel for chemical and metallurgical industry. During that period, Ryerson technical men have gained much practical experience about the best type of steel for the many applications in the industry. This service is available to you on any problem of selection or fabrication.

3. Fast, Accurate Preparation—Ryerson saves you time and expense—prepares steel to your exact specifications with modern, precision equipment. Facilities include high-speed hack saws and shears, batteries of flame cutters, punches—everything needed to cut steel to the size and shape you need in the shortest possible time.

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Metal Working Machinery and Tools.

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RYERSON STEEL

NEW CONSTRUCTION

PROPOSED WORK

Conn., Rocky Hill—Hartford Rayon Corp., Dividend St., is having plans prepared by Buck & Buck, Engrs., 650 Main St., Hartford, for an addition to its factory. Estimated cost will exceed $40,000.

Minn., South St. Paul—Swift & Co., 4115 South Packers St., and Union Stockyards, Chicago, Ill., plans to construct a glue factory. Estimated cost $40,000.

Ore., The Dalles—Northwest Chemurgy Co-operative, Wenatchee, Wash., plans to construct a 6 story, 90x250 ft. starch factory and two 3 story buildings for the production of dextrose and glucose. Estimated cost $300,000.

Ore., Willbridge (Portland P. O.)—California Ashphalt Corp., subsidiary of Standard Oil Co. of California, 225 Bush St., San Francisco, Calif., plans to construct an asphalt refinery here. Estimated cost $1,000,000.

Pa., Glen Rock—Foust Distilling Co., Glen Rock, plans to construct additions to its distillery. Estimated cost $150,000.

Pa., Meadville—David Meade Distilling Co., Race St., plans to construct four 8 story, 75x125 ft. warehouses. Jos. Breslove, Leader Bldg., Cleveland, O., Archt.

Tex., Freeport—Dow Chemical Co., Freeport, and Midland, Mich., plans to construct a plant for the manufacture of Perchlorethylene. This is part of $15,000,000 chemical manufacturing plant to be constructed here.

Tex., Port Neches—Jefferson Chemical Co., jointly owned by American Cyanamid Co., 30 Rockefeller Plaze and Texas Co., 135 East 42nd St., Both of New York City., plans to construct a large chemical manufacturing plant here.

Tex., Sheridan—Shell Oil Co., Shell Bldg., Houston, plans to construct a recycling plant here. Estimated cost $3,000,000.

CONTRACTS AWARDED

Calif., Apex—U. S. Line Products Corp., Sloan, Nev., has awarded the contract for the construction of a primary and secondary crushing plant and quarry here to Walter A. Stinson c/o Owner. Estimated cost $85,000.

Calif., Richmond—Standard Oil Co., 225 Bush St., San Francisco, has awarded the contract for a process laboratory to Parker, Steffens & Pearce, 135 South Park St., San Francisco. Estimated cost $2,000,000.

Fla., Pensacola—Florida Pulp & Paper Co., Pensacola, will improve and enlarge its plant here. Work will be done with own forces. Estimated cost $350,000.

La., Oakdale—Newport Industries, Inc., Pensacola, Fla., has awarded the contract for the construction of a rosin and turpentine plant to Stone & Webster Engineering Corp., 90 Broad St., New York, N. Y. Estimated cost $2,500,000.

	Current Projects		Cumulative 1945	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$40,000	$140,000	$3,250,000	$16,604,000
Middle Atlantic	190,000	1,890,000	5,562,000	31,416,000
South	.....	2,850,000	19,338,000	34,357,000
Middle West	.....	36,036,000	11,749,000	61,301,000
West of Mississippi	4,040,000	4,351,000	83,712,000	90,850,000
Far West	1,300,000	2,135,000	6,045,000	11,448,000
Canada	.....	1,250,000	8,769,000	3,331,000
Total	$5,570,000	$48,652,000	$138,425,000	$249,307,000

Mass., Everett—Carpenter-Morton Co., 77 Sudbury St., Boston, has awarded the contract for a 5 story paint plant addition to Bond Bros., 77 Ferry St., Everett. Estimated cost $100,000.

Mass., Norwood—Bird & Son., Inc., Washington St., East Walpole, has awarded the contract for the construction of a lacquer wax building to Vappi & Co., Inc., 240 Sidney St., Cambridge. Estimated cost $40,000.

Mich., Rockford—Wolverine Tanning Co., Rockford, has awarded the contract for a tannery and leather products plant to Beckering Construction Co., 2140 Horton St., Grand Rapids. Estimated cost $200,000.

Minn., International Falls—Minnesota & Ontario Paper Co., 500 Baker Arcade Bldg., Minneapolis, has awarded the contract for the construction of a laboratory to P. A. Laurence Co., 832 Builders Exchange, Minneapolis, Estimated cost $40,000.

N. J., Trenton—Sterling Drug Co., 170 Varick St., New York, N. Y., has awarded the contract for design and construction of 203x340 ft. aspirin manufacturing plant to Austin Co., 19 Rector St., New York City. Estimated cost $1,600,000.

O., Cincinnati—Procter & Gamble Co., Grove Ave. and June St., Ivorydale, has awarded the contract for administration laboratory and research building to Ferro Concrete Construction Co., Third and Elm Sts. Estimated cost $500,000.

O., Cochocton—General Electric Co., Plastics Div., Pittsfield, Mass., has awarded the contract for a laminated plastics plant here to The Austin Co., 16112 Euclid Ave., Cleveland, at $4,706,204.

O., Lorain—National Tube Co., Frick Bldg., Pittsburgh, Pa., has awarded the contract for the construction of 177 new by-product coke ovens at its plant here to Wilputte Coke Oven Corp., 40 Rector St., New York City. Estimated cost $30,000,000.

O., Middletown—Sorg Paper Co., 901 Manchester Ave., has awarded the contract for new building to house boilers and water treatment plant to McGraw Construction Co., American Bldg., Middletown. Estimated cost $500,000.

O., Toledo—Ottawa River Paper Co., Terminal R. R. and Matzinger Rd., has awarded the contract for a 1 story addition to its plant to George Lathrop & Son, Inc., 1510 Montcalm St. Estimated cost $50,000.

Ore., Portland—Westcraft Paint Co., c/o Preservative Paint Co., 5410 Airport Way, Seattle, has awarded the contract for a 1 story warehouse to C. Gilmer, Spalding Bldg. Estimated cost $50,000.

Pa., Borough Township—Petroleum Solvents Co., Butler Savings & Trust Bldg., Butler, has awarded the contract for warehouse, loading docks, railroad siding, etc., to Pihl & Miller, Wabash Bldg., Pittsburgh. Estimated cost $100,000.

Pa., Latrobe—Mennametal, Inc., Lloyd Ave., has awarded the contract for the construction of a 2 story laboratory building to John Ridilla, P. O. Box 150, Latrobe. Estimated cost $40,000.

Pa., Philadelphia—Charles Lennig & Co., 5000 Richmond St., manufacturing chemists, have awarded the contract for a factory building to Frank V. Warren, Inc., Lewis Tower Bldg. Estimated cost $150,000.

Tex., Baytown—General Tire & Rubber Co. has awarded the contract for the construction of an effluent treatment plant here to Tellepson Construction Co., 3900 Clay St., Houston. Estimated cost $225,000.

Tex., Carthage—Chicago Corp. c/o Tennessee Gas & Transmission Co., Commerce Bldg., Houston, has awarded the contract for a recycling or high pressure gasoline manufacturing plant to Stearns-Rogers Construction Co., Union National Bank Bldg., Houston and Carthage. Estimated cost $3,000,000.

Tex., Dallas—Certain-Teed Products Corp., Tower Petroleum Bldg., has awarded the contract for the first and second units of a roofing manufacturing plant to Meers Construction Co., Great National Life Bldg., Dallas. Estimated cost $400,000 and $600,000, respectively.

Tex., San Antonio—Nelson Tannery, Inc., Alamo National Bank Bldg., has awarded the contract for the construction of a tannery to Hill & Combs, 321 Melrose Pl., at $85,000.

Wis., Neenah—Neenah Paper Co., North Commercial St., has awarded the contract for a 4 story, 70x90 ft. factory addition to C. R. Meyer & Sons Co., 50 State St., Oshkosh.

Wis., Milwaukee—Wisconsin Paint Manufacturing Co., 3710 North Richards St., has awarded the contract for an addition to its factory to Selzer-Ornst Co., 6222 West State St., Wauwatosa. Estimated cost $40,000.

B. C., New Westminster—Westminster Paper Co., Ltd., 5th Ave. and 16th St., has awarded the contract for an addition to its plant to Dominion Construction Co., 150 W. 1st Ave., Vancouver, B. C. Estimated cost $1,250,000.